The Value of Measuring Quality of Primary Care using Patient-Reported Depression Collected Through Electronic Health Records

by
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Abstract

Statement of the problem: Depression is a common condition that is often under-diagnosed and under-treated. Depression screening in primary care is both a Healthy People 2020 goal, and is being promoted through Medicare's Annual Wellness Visit (AWV) benefit--a preventive care screening visit that is free for Medicare Part B beneficiaries.

Methods: A secondary analysis of retrospectively collected electronic health record (EHR) data from 5,000 Medicare patients. Quota-random sampling was used so that half of the patients had an AWV and half of the patients had at least one primary care visit during the study period (2010-2012). Scores on the Patient Health Questionnaire, a validated patient-reported depression screening tool, were collected from structured fields in the EHR. Bivariate and multivariable logistic regressions were used to determine the odds of depression screening and meeting quality measures for depression.

Results: Overall, depression screening was low, at 17%. In the cross-sectional analysis of the patients' index visit, AWV patients were not more likely to receive depression screening at a statistically significant level in either the bivariate or the multivariable model, after accounting for clustering at the physician level(OR 1.28 95%CI:0.86-1.94; OR 1.33 95%CI:0.88-2.00, respectively). There was a clear clinic site effect of depression screening with one site screening 78% of AWV patients and 83% of non-AWV patients and six sites screening none of their patients. In the adjusted longitudinal analyses, having multi-morbidity was associated with decreased odds of receiving both depression and smoking status screenings compared to receiving neither or only smoking status screening by 28% after adjusting for race, age, and sex.(AOR: 0.72, 95%CI:0.52-1.0).

Conclusions: Depression screening rates were low whether they were examined cross-sectionally or longitudinally. After adjusting for patient factors and clustering at the clinician and site level, the odds of depression screening were not significantly different between patients who received an AWV visit and those who did not. Our work shows that requiring depression screening as part of a Medicare benefit is not a strong enough incentive to increase depression screening.

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Introduction

Historically, much of health care has been focused on physical health,[1] however, mental health issues are both common and costly.[2,3] Patients with mental health problems experience decreased quality of life and increased mortality relative to the general population.[4] One of the most prevalent mental health diseases is depression, affecting 1 in 6 older adults in the U.S..[5,6] World-wide, major depressive disorder is a major cause of total years-lived with disability.[7]

The interaction of the burden of depression and co-morbid disease has been widely studied.[8] Persons reporting at least one chronic physical disease are more likely to report depression; and patients who report depression co-morbid with another physical disease have lower mean health scores compared to patients reporting two or more physical comorbidities.[9] Depression after physical impairment has been shown to result in poorer long term recovery.[10]

Depression treatment is often effective[11] but under-treatment is common.[12,13] Older adults are often treated for depression in primary care as opposed to speciality care.[13] Patients with depression who are treated in primary care without staff-assisted depression care support, are less likely to have improved symptoms and are more likely to die.[14,15] Interventions in the primary care setting that have shown positive outcomes for patients with depression include providing educational materials, and a visit with a depression care manager in which depression care preferences were discussed.[14,15] Without an explicit intervention, only 20% of Medicare patients diagnosed with depression have at least one visit with a mental health specialist while 60% received an antidepressant.[15]

The U.S. Preventive Service Task force recommends depression screening only when "staff-assisted depression care supports are in place."[16] A systematic review found that screening for depression in older adults without "substantial staff-assisted depression care

supports" is not likely to improve depression outcomes.[17] While increasing depression screening in primary care practices is a HealthyPeople2020 goal,[2] the Canadian Task Force on Preventive Health Care did not recommend routine depression screening for adults.[18]

Initiatives are ongoing to systematize and incentivize screening to improve quality of care. The National Quality Forum used depression as an example of a patient-reported outcome that has been developed into a patient-reported quality measure.[19] Starting in 2010, clinics in Minnesota are reporting the Patient Health Questionnaire (PHQ)-9 depression screening tool as part of a quality measurement initiative.[20] In 2011, the Centers for Medicare and Medicaid Services started paying for annual depression screening, as well as other preventive care screenings at no cost to the patient,[21] but are reimbursed at high rates to providers.[22] Further, screening for clinical depression is part of Meaningful-Use Stage 2's adult core 2014 clinical quality measures.[23,24] In 2008, the United Kingdom began incentivizing collection of patient reported outcomes; and the clearest benefits of this program were improvements in care processes, including diagnosis of depression.[25] Yet, at least one peer-reviewed article suggested that the evidence did not support depression screening as a quality measure.[26]

With these current policy initiatives, and mixed evidence, assessing the value of using patient-reported depression as a quality of care indicator is vital. Results from this study will therefore fill a clear gap in the literature since no study has looked at depression screening as a quality of care indicator derived from electronic health records for older adults in a primary care setting, although it is this population for whom depression screening is being incentivized. Results from this study will 1) assess impact of a federal policy to promote preventive screening on depression screening practice; 2) provide insight regarding whether mental health screening (e.g. depression) occurs at the same frequency as physical health screening (e.g. tobacco); 3) assess patient factors that impact the rate of completion of

quality measures. Most importantly, this study will help us understand the use of depression screening as a patient-reported outcome measure, as well as assess whether there are potential disparities in care due to unintentional consequences of these quality of care incentives.

Dissertation Objective

Depressive symptoms increase in older age.[27] Depressed older adults have poorer functional status[28] and utilize more health care than non-depressed older adults.[29] Older-adults are also at increased risk for suicide compared to the general population, and depression is a major cause of suicide.[5] Primary care physicians are more likely to treat a patients' physical symptoms rather than mental or emotional problems[30] despite the fact that effective treatments for depression exist.[14] Crucially, both older adults and persons with depression have higher rates of multiple chronic conditions than the general population.[12,31] Patients presenting with multiple chronic conditions may be less likely to be screened or treated for mental health problems, due to providers' prioritizing physical symptoms ahead of mental or emotional ones.

Patient-reported process of care measures, such as adherence to screening guidelines, are increasingly being collected through electronic health records(EHRs).[32] Use of EHR data allows important variations in screening practices to be identified. For example, are patients screened more often at one site instead of another? Are patients with multiple chronic conditions screened for depression more often? Since the health status of older adults is heterogeneous, understanding who is screened can illuminate inequities in the provision of care and identify opportunities for quality improvement interventions aimed at improving both care processes and outcomes.

Understanding the impact of measuring quality of care using a patient-reported depression screening tool during this time of expanding health care and limited primary care

providers is vital,[33] especially when evidence for depression screening is mixed[34] and Medicare is paying physicians to screen for depression annually during Annual Wellness Visits (AWVs).[21] The primary objectives of this study are to: 1) evaluate whether having an AWV is associated with the use of screening, after adjusting for patient factors and clustering at the physician and clinic level; 2) delineate whether depression screening is conducted differently than other preventive care screenings (e.g. smoking status screening); and 3) identify the prevalence and correlates of meeting depression screening quality measures.

References:

1. Breslow L. A quantitative approach to the World Health Organization definition of health: physical, mental and social well-being. Int J Epidemiol. 1972 Winter;1(4):347-55.
2. U.S. Department of Health and Human Services. HealthyPeople2020: Mental Health and Mental Disorders. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=28. Accessed May 2, 2013.
3. American Academy of Family Physicians. Final 2012 Medicare Physician Fee Schedule. Available at: http://www.aafp.org/online/etc/medialib/aafp_org/documents/policy/fed/background/schedule110711.Par.0001.File.tmp/AAFPSummaryFinal2012MPFS112911.pdf. Accessed May 2, 2013
4. Kilbourne AM, Welsh D, McCarthy JF, Post EP, Blow FC. Quality of care for cardiovascular disease-related conditions in patients with and without mental disorders. J Gen Intern Med. 2008 Oct;23(10):1628-33.
5. National Institute of Mental Health. Older Adults: Depression and Suicide Facts (Fact Sheet). Available at: http://www.nimh.nih.gov/health/publications/older-adults-depression-and-suicide-facts-fact-sheet/index.shtml. Accessed May 6, 2013.
6. Centers for Medicare and Medicaid. Decision Memo for Screening for Depression in Adults (CAG-00425N). Available at: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=251#_ftn5. Accessed May 2, 2013.
7. Vos T, Flaxman AD, Naghavi M,, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study Lancet. 2012 Dec 15;380(9859):2163-96
8. Goldman LS, Nielsen NH, Champion HC. Awareness, Diagnosis, and Treatment of Depression. Journal of General Internal Medicine. 1999 Sept. 14;8: 569–580,
9. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet. 2007 Sep 8;370(9590):851-8.
10. Phillips AC, Upton J, Duggal NA, Carroll D, Lord JM. Depression following hip fracture is associated with increased physical frailty in older adults: the role of the cortisol: dehydroepiandrosterone sulphate ratio. BMC Geriatr. 2013 Jun 17;13(1):60.
11. Insel TR, Wang PS. The STAR*D trial: revealing the need for better treatments. Psychiatr Serv 2009 Nov; 60(11):1466-7.
12. Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). JAMA. 2003 Jun 18;289(23):3095-105.
13. Park M, Unützer J. Geriatric depression in primary care. Psychiatr Clin North Am. 2011 Jun;34(2):469-87
14. Gallo JJ, Morales KH, Bogner HR, et al. Long term effect of depression care management on mortality in older adults: follow-up of cluster randomized BMJ. 2013 Jun 5;346:f2570.
15. Unützer J, Katon W, Callahan CM, et al. Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. JAMA. 2002 Dec 11;288(22):2836-45.
16. O'Connor EA, Whitlock EP, Beil TL, Gaynes BN. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Intern Med. 2009 Dec 1;151(11):793-803
17. O'Connor EA, Whitlock EP, Gaynes B, Beil TL. Screening for Depression in Adults and Older Adults in Primary Care: An Updated Systematic Review. Evidence Synthesis No. 75. AHRQ Publication No. 10-05143-EF-1. Rockville, Maryland: Agency for Healthcare Research and Quality, December 2009
18. Canadian Task Force on Preventive Health Care, Joffres M, Jaramillo A, Dickinson J, et al. Recommendations on screening for depression in adults. CMAJ. 2013 Jun 11;185(9):775-82
19. National Quality Forum. Patient Reported Outcomes (PROs) in Performance Measurement. 2013. Jan. Available at: http://www.qualityforum.org/Publications/2012/12/Patient-Reported_Outcomes_in_Performance_Measurement.aspx). Accessed May 29, 2013.
20. Minnesota Community Measurement. Minnesota Health Scores Overview. Available at: www.mnhealthscores.org. Accessed May 4, 2013
21. Medicare Learning Network: Quick Reference Information: the ABCs of Providing the Annual Wellness Visit. Available at: http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/AWV_Chart_ICN905706.pdf. Accessed November 6, 2012

22. American Academy of Family Physicians. Final 2012 Medicare Physician Fee Schedule. Available at: http://www.aafp.org/online/etc/medialib/aafp_org/documents/policy/fed/background/schedule110711.Par.0001.File.tmp/AAFPSummaryFinal2012MPFS112911.pdf Accessed May 2, 2013
23. Centers for Medicare and Medicaid. Additional Information Regarding EP Clinical Quality Measures for 2014 EHR Incentives Programs. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/EP_MeasuresTable_Posting_CQMs.pdf. Accessed May 17, 2013
24. Centers for Medicare and Medicaid Services. Clinical Quality Measures Tipsheet. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/ClinicalQualityMeasuresTipsheet.pdf Accessed July 10, 2013
25. Black N. Patient reported outcome measures could help transform healthcare. BMJ. 2013 Jan 28;346:f167.
26. Daniel J Luchins, Depression screening as a quality indicator Ment Health Fam Med. 2010 June; 7(2): 107–113.
27. Sutin AR, Terracciano A, Milaneschi Y, An Y, Ferrucci L, Zonderman AB. The Trajectory of Depressive Symptoms Across the Adult Life Span. JAMA Psychiatry. 2013 Jun 12:1-9.
28. Grabovich A, Lu N, Tang W, Tu X, Lyness JM. Outcomes of subsyndromal depression in older primary care patients. Am J Geriatr Psychiatry. 2010 Mar;18(3):227-35.
29. Pickett YR, Ghosh S, Rohs A, Kennedy GJ, Bruce ML, Lyness JM. Healthcare Use Among Older Primary Care Patients With Minor Depression. Am J Geriatr Psychiatry. 2013 Apr 9.
30. Kravitz RL, Ford DE. Introduction: chronic medical conditions and depression--the view from primary care. Am J Med. 2008 Nov;121(11 Suppl 2):S1-7.
31. Daumit GL, Anthony CB, Ford DE, et al. Pattern of mortality in a sample of Maryland residents with severe mental illness. Psychiatry Res. 2010 Apr 30;176(2-3):242-5.
32. Centers for Medicaid and Medicare Services. Roadmap for Quality Measurement in the Traditional Medicare Fee-For-Service Program. 2008. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityInitiativesGenInfo/downloads/QualityMeasurementRoadmap_OEA1-16_508.pdf. Accessed February 19, 2013.
33. Petterson SM, Liaw WR, Phillips RL Jr, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010-2025. Ann Fam Med. 2012 Nov-Dec;10(6):503-9.
34. O'Connor EA, Whitlock EP, Gaynes B, et al. Screening for Depression in Adults and Older Adults in Primary Care: An Updated Systematic Review [Internet].Evidence Syntheses, No. 75. Rockville (MD): Agency for Healthcare Research and Quality (US); 2009 Dec.

Impact of Medicare Annual Wellness Visits on Depression Screening

Abstract

Importance: Medicare is promoting depression screening through their Annual Wellness Visit (AWV) benefit for Part B beneficiaries. It is known that there are barriers to depression screening in primary care, but it is unknown how this new benefit affects depression screening.

Objective: To assess whether having an AWV is associated with increased odds of depression screening, after adjusting for patient factors and clustering at the physician and clinic level.

Design: Cross-sectional analysis of retrospectively collected electronic health record data from October, 2010-August, 2012.

Setting: Data was collected from 198 primary care physicians in 34 clinics.

Participants: Participants were Medicare patients 65 years or older who had at least one primary care visit during the study period. Quota-random sampling was used so that half had an AWV index visit and half had a non-AWV primary care index visit during the study period.

Intervention: Having an AWV index visit versus having a primary care index visit.

Main Outcome: Depression screen during patients' index visit.

Results: Depression screening during the index visit was low with 15% of non-AWV patients screened and 10% of AWV patients screened. After accounting for physician and site clustering, AWV patients were not more likely to receive depression screening at a

statistically significant level (OR 1.33 95%CI:0.88-2.00). Intraclass correlation for within clinician depression screening was strong, at 0.83. There was a clear site effect of screening with one site screening 78% of AWV patients and 83% of non-AWV patients, and six sites screening none of their patients

Conclusions: This study found that overall, depression screening during patient's index AWV was uncommon (10%). After adjusting for patient factors and clustering at the clinician and site level, the odds of depression screening were not significantly different between patients who received an AWV visit and those who did not. Our work shows that requiring depression screening as part of a Medicare benefit is not a strong enough incentive to increase screening. Future work that aims to increase depression screening should assess factors associated with the site variations in depression screening.

Introduction

Depression is one of the most prevalent mental health diseases, affecting 1 in 6 older adults in the United States.[1] Depressed older adults tend to have poorer functional status[2] and utilize more health care than non-depressed older adults.[3] Furthermore, older adults are at increased risk for suicide compared to the middle-aged adults, and depression is a major contributing factor.[4] Primary care clinicians are more likely to treat their patients' physical symptoms rather than their mental or emotional problems.[5] This is particularly relevant since depression is known to co-occur with other diseases,[6] and older adults with depression often have multiple other chronic conditions.[7,8] Therefore, patients at highest risk for depression may have numerous health concerns competing for clinicians' time and attention.

A recent qualitative study of outpatient clinicians found that there may be systematic under-use of depression screening due the viewpoint that assessment and management of physical health problems should take precedence over depression screening, as well as concerns about follow-up care for patients who screen positive for depression.[9] Further, there is mixed guidance on the importance of routinely screening for depression in primary care,[10,11] and it is uncertain whether depression screening alone improves outcomes.[12] This vacillation in the literature may result in clinician's screening based on their attitudes towards depression screening.[13] Previous work has found that office organization and prevention delivery attitudes were associated with higher rates of delivery of U.S. Preventive Service Task Force recommendations;[14] and, routine depression screening with sufficient staff supports was recommended in 2009 by the U.S. Preventive Service Task Force.[10]

In 2011, depression screening was incorporated as a required component in a patient's initial Medicare's Annual Wellness Visit (AWV). The purpose of the AWV is to allow time to "develop or update a personalized prevention plan."[15] AWV visits are reimbursed at a higher revenue-value unit rate, which creates an incentive for a visit intended

to include depression screening.[16] This provides a unique opportunity to assess whether requiring depression screening during a preventive care visit increases depression screening compared to routine primary care visits. The objective of this study is to assess whether having an AWV is associated with increased odds of depression screening, after adjusting for patient factors and clustering at the physician and clinic level.

Methods

Study population

This is a cross-sectional study of retrospectively collected electronic health record (EHR) data from 5,000 Medicare-covered patients across 198 physicians working in 34 primary care practices in Maryland and Washington, D.C.. Physicians were Internal Medicine or Family Medicine specialists. Quota-random sampling was used so that half of the patients had an AWV visit and half of the patients had a non-AWV primary care visit as their index visit. A patient's index visit was his/her visit identified between September, 2010-August, 2012 which enabled the patient to be eligible for the study. All patients had only one index visit, and this visit was used as the basis for the study analysis. Of the non-AWV index visits, 48 percent were for chronic care, 32 percent for preventive care and 20 percent for other reasons. One hundred and forty-five individuals who had Welcome to Medicare visit on their index visit were excluded from the non-AWV index visit group since the Welcome to Medicare benefit includes preventive care screenings which are similar, but not the same, as the Annual Wellness Visit benefit.[15] An additional 3 patients were excluded because their index visit clinician was a podiatrist or an acupuncturist, leaving a final sample size of 4,852 people.

Data Collection

Clinicians used General Electronic Health's Centricity EHR system which was implemented in 2007. This EHR system was designed for ambulatory office settings and can interface with practice management systems. Data on the use of the patient health questionnaire (PHQ), a validated patient-reported depression screening tool, was collected from structured observation fields in the EHR. The template allowed clinicians to answer the first two questions (the PHQ-2), regarding Diagnostic and Statistical Manual's (DSM-IV) two main symptoms of major depression (i.e., depressed mood and anhedonia), and then if the patient answered positively to any one of these questions, continued to the longer PHQ-9 template. For clarity, the term PHQ-9 will be used to refer to both the PHQ-2 and PHQ-9 throughout this manuscript.

Dependent Variable

The dependent variable was receiving a PHQ-9 screening during the patient's index visit occurring between September 1, 2010 and August 31, 2012.

Independent Variable

The type of index visit, categorized as AWV-index versus non-AWV-index, was the independent variable of interest. Elements of an AWV visit include acquiring the patient's history through a health risk assessment, establishing medical/family history, and reviewing a patient's risk factors for depression, including current or past experiences with depression. The AWV also includes assessment of the patient's height and weight, identifying the patient's care team and detecting any cognitive impairments. Finally, the clinician should counsel the patient through providing health advice and referrals as appropriate, determining a written schedule of screenings and identify risk factors and conditions for which primary, secondary or tertiary interventions are recommended.[16] AWV visits were defined by a code of G0438 or G0439 in the EHR.[17]

Covariates

Patient-level covariates included demographics (age, race, sex) and the patient's active diagnoses. The interaction of sex and age was included since older women are more likely to experience depression, but suicide is more prevalent among white males over the age of 85.[18]

Diagnoses were obtained from the patient's full problem list using ICD-9 code diagnosis, and determined to be active if the diagnosis date was prior to the index date and either there was no stop date or the stop date was after the index date. Four representative diagnoses known to be prevalent and strongly associated with depression were included in the analysis: cancer, diabetes, hypertension and Alzheimer's dementia. Hypertension, diabetes and cancer were included because of their known relationship with depression among older adults.[19,20] Alzheimer's dementia was included since patients with dementia may have a decreased ability to answer patient-reported outcomes, such as the PHQ-9.

Multimorbidity (e.g. two or more chronic diseases) was also included as a covariate in the analyses since it has been shown to be associated with depression.[21] Multimorbidity was defined by having 2 or more active diagnoses for common chronic conditions (hyperlipidemia, hypertension, rheumatoid arthritis, diabetes, ischemic heart disease, chronic kidney disease, depression, osteoporosis, chronic obstructive pulmonary disorder, cancer, asthma, atrial fibrillation, stroke, or heart failure). All diagnoses were based on ICD-9 code definitions from the Medicare Chronic Conditions Data Warehouse.[22]

Analysis

Multi-variable logistic regressions were used to examine the association of index visit type with depression screening during the index visit. A stepwise approach to analyses was adopted, in which patient-level variables were added to the model one by one to adjust for their potential confounding effects. Clustered-hierarchical models as implemented in the STATA xtmelogit were used to take clustering at physician and clinic level into account. An

identity covariance structure was used assuming that there was equal variances for all random effects at both the physician and site level.[23] Output is reported in odd-ratios. Between-physician variance is reported for models that control for physician and site clustering.

Models were compared using AIC, BIC, and McFadden's Adjusted R2 at the patient-level and log-likelihood ratios at all levels.(Appendix) Sensitivity analysis was conducted by rerunning the multivariable regressions with and without clustering at the physician level to assess the impact of site 34 (the site with the highest screening rates) on odds of depression screening. All analyses were conducted using Stata 12.0.

Results

Patients sampled were on average 72 years old, 61% were white, 61% were female and 48% had at least one AWV. In total, 606 patients (12%) had a depression screen on their index visit. Receipt of depression screening on the index visit did not differ by sex. However, blacks, and adults with a non-AWV index visit were significantly more likely to be screened for depression. (Table 1) There was a pronounced differences in racial distribution across different sites.(Appendix) In contingency table analyses, non-AWV index patients had significantly more depression screening than AWV-index patients (15% vs. 10%; $p<0.01$). (Table 1)

Multivariable logistic regression analyses

The regression that controlled for age, sex, and race had the best fit with the smallest AIC and BIC on the patient (first) level.[24] The addition of covariates was compared using likelihood-ratio tests post-estimation. Adding health status variables did not improve the fit of the model. (Not shown.)

In a multivariable logistic regression not accounting for clustering by clinician, the odds of depression screening on the index visit changed with the inclusion of patient-level

covariates. Specifically, after controlling for race, age, and sex, the odds of depression screening during an AWV visit changed from 0.62 to 1.19. Additionally, blacks had significantly higher odds of depression screening compared to whites in the multivariable model without adjusting for clustering (OR: 6.12; 95%CI:5.01, 7.50).

After accounting for clustering at the clinician level, AWV-index patients were no more likely to receive depression screening, compared to non-AWV index patients, at a statistically significant level in either the bivariate or the multivariable model(OR 1.28 95%CI:0.86-1.94; OR 1.33 95%CI:0.88-2.00, respectively). Additionally, the racial difference in screening disappeared after adjusting for clinician clustering. The intraclass correlation, which is a measure of within-clinician screening practices, was very strong (0.83) indicating the need for multilevel models. Further, the odds of depression screening for patients with an AWV-index visit compared to a non-AWV index after controlling for age, sex and race varied by 18% between clinicians.(Table 2)

Site factors accounted for part of the variance in depression screening observed between physicians. Adjusting for site correlation decreased within physician intraclass correlation from approximately 0.85 to 0.45. The association of patient-level confounders were similar regardless of whether clinician only or clinic site and clinician clustering were accounted for in the model. The average odds of depression screening for patients with an AWV-index visit compared to a non-AWV index decreased to 11% between clinicians once site clustering was account for in the model.(Table 2)

Percent of Depression Screens by Visit Type for Sites

The percent of depression screens by visit type was broken down by site for sites that had more than 100 patients (Figure). There was a clear site effect of depression screening with site 34 screening 78% of AWV-index patients and 83% of non-AWV index

patients. Six sites screened none of their AWV-index patients or their non-AWV index patients.

Sensitivity Analysis

The results of the sensitivity analysis found that site 34 had a important impact on the overall odds of depression screening. When only site 34 was analyzed, the odds of depression screening was 44% lower for patients with an AWV index visit compared to a non-AWV index visit controlling for age, sex and race. However, when site 34 was excluded from the analysis, patients with an AWV index visit had 4-fold greater odds of depression screening than patients with a non-AWV index visit controlling for age, sex and race.(Table 3)

Discussion

This study found that overall, depression screening during patient's AWV was low (10%). In the bivariate regression modeling the relationship between depression screening and index visit type, patients with a non-AWV index visit were 38% more likely to be screened for depression than AWV index patients. After adjusting for patient factors and clustering at the clinician and site level, the odds of depression screening were not significantly different between patients who had an AWV visit and patients who had a primary care visit. Screening for depression screening during a preventive care visit was strongly associated with clinician and practice site. Without accounting for these additional clustering factors, patient-level determiners such as race would have appeared highly associated with the odds of depression screening. Further, the best fitting model did not include patient health factors such multimorbidity, cancer, diabetes, hypertension or dementia.

Surprisingly, we found a very prominent clinician and site effect of screening, despite the AWV benefit. One site screened 78-83% of patients during their index visit indiscriminately of whether the visit was an AWV or primary care visit, and six sites screened none of their patients. In the regression models, the intraclass correlation, was very strong (0.83) implying a clinician provided the same level of screening for all patients. These results suggest that simply providing patients with the opportunity to receive mental health preventive care through the AWV benefit is not sufficient for that care to occur. The sensitivity analysis found that the AWV benefit significantly increased the odds of depression screening among sites that had lower overall screening rates. However, as seen in the figure, this effect was not uniform across all sites with seven sites not screening any AWV-index patients for depression. Policy initiatives interested in increasing depression screening equably among clinics should consider how the benefit will be implemented.

Medicare's AWV benefit began in January, 2011 with the goal to increase access to preventive care. The AWV was not intended to replace patients' yearly physical, but instead to provide time to discuss new or chronic medical conditions.[25] Depression screening is explicitly included as an essential task during a patient's initial AWV visit. Since our study took place in 2011 and 2012, and patients cannot have two AWVs within 12 months of each other, we are confident that our sample includes patient's initial AWV visit. Other tasks included as part of the AWV are: taking patient's history through a health risk assessment, establishing medical/family history, taking patient's height and weight, identifying the patient's clinicians and detecting any cognitive impairments. Clinicians may be prioritizing other tasks over depression screening, especially since previous work has found that clinicians have been cautious about the validity of depression screening tools and prefer clinical judgement in determining whether a patient has depression.[26]

The U.S. Preventive Service Task force recommends depression screening only when "staff-assisted depression care supports are in place"; yet, staff-assisted depression supports can be as minor as having a nurse notify the physicians of the patient's score.[10] Conversely, the Canadian Task Force on Preventive Health Care did not recommend routine depression screening for adults.[11] A systematic review found that screening for depression in older adults without "substantial staff-assisted depression care supports" is not likely to improve depression outcomes.[27] This mixed-evidence, plus the need for sufficient depression screening supports, may explain the substantial site difference in screening. Indeed, a qualitative study found that clinicians reported concern about both how to screen for depression, and the lack of options available if a patient were diagnosed with depression.[28]

As shown in our figure, one practice site was the main contributor to depression screens, regardless of whether the patient had an AWV-index visit or not. Previous studies on variation in the delivery of health care have shown that variation in care is not indicative of higher quality care.[29,30] Physicians face competing priorities when deciding which services to recommend to patients including patients' health care needs, organizational and financial barriers and facilitators, and mixed evidence regarding the effectiveness of care.[29] Recent work on clinic predictors of adopting a depression care improvement model in Veterans' Affairs found that sites with poor communication among staff, fewer quality improvement processes, insufficient financial resources, and no psychologist or psychiatrists on staff had a 40%-62% reduced odds of adopting a depression care improvement model.[31]

There are several limitations to our study. We conducted a cross-sectional analysis, and therefore no comments regarding causation can be made. Further, none of the models fit especially well on the patient level, even when including patient health factors, such as multimorbidity status. There were very clearly clinician and site level factors, which we could

only account for using clustering in our models. Notably, our ability to account for clustering within both clinicians and sites is a major strength of this work. Finally, our study occurred during the first 20 months of the AWV benefit and depression screening during the AWV may have increased since that time.

Conclusion

Our work shows that requiring screening as part of a Medicare benefit is not a strong enough incentive to overcome barriers to depression screening that were not addressed through clinic practice style. Further work should be done to identify which practice characteristics promote appropriate depression screening, and facilitate compliance with Medicare's AWV. There should also be evaluations on barriers to depression screening during patient's AWV. We need to have a better understanding whether depression screening has value for patients in this context, and if patients and clinicians find other activities more valuable. Finally, when designing interventions to increase screening for specific patient groups, patterns of care should be carefully evaluated first, including variations in care among clinicians and between sites.

References

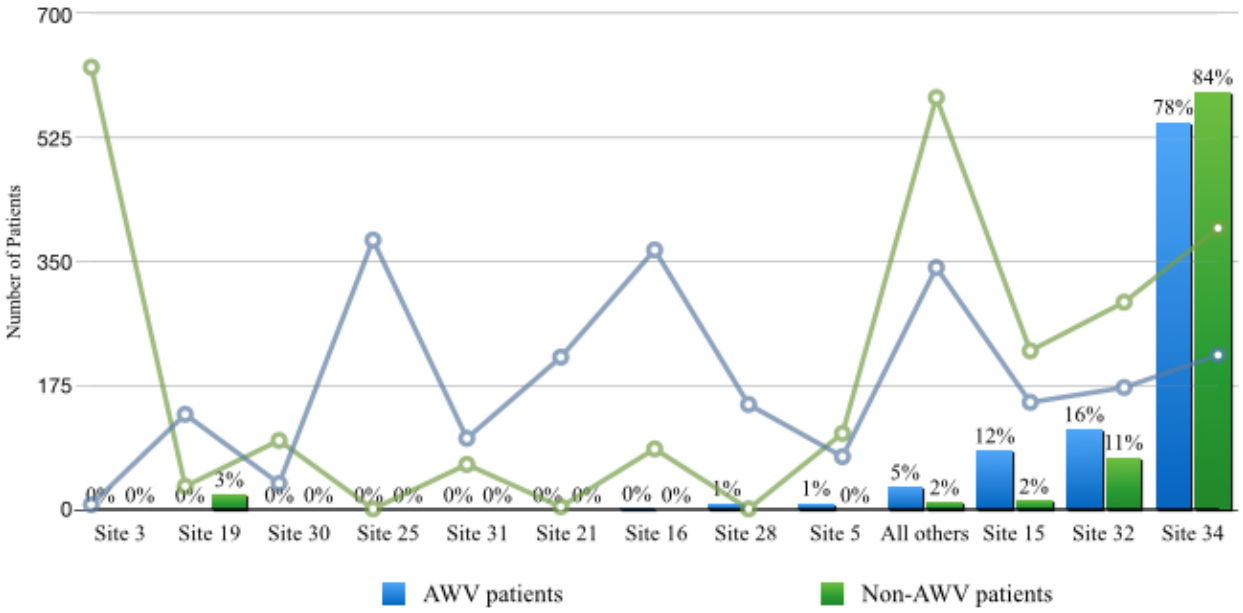
1. Centers for Medicare and Medicaid. Decision Memo for Screening for Depression in Adults (CAG-00425N). Available at: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=251#_ftn5. Accessed May 2, 2013.
2. Grabovich A, Lu N, Tang W, Tu X, Lyness JM. Outcomes of subsyndromal depression in older primary care patients. Am J Geriatr Psychiatry. 2010 Mar;18(3):227-35.
3. Pickett YR, Ghosh S, Rohs A, Kennedy GJ, Bruce ML, Lyness JM. Healthcare Use Among Older Primary Care Patients With Minor Depression. Am J Geriatr Psychiatry. 2013 Apr 9.
4. National Institute of Mental Health. Older Adults: Depression and Suicide Facts (Fact Sheet). Available at: http://www.nimh.nih.gov/health/publications/older-adults-depression-and-suicide-facts-fact-sheet/index.shtml. Accessed May 6, 2013.
5. Kravitz RL, Ford DE. Introduction: chronic medical conditions and depression--the view from primary care. Am J Med. 2008 Nov;121(11 Suppl 2):S1-7
6. Phelan E, Williams B, Meeker K, et al. A study of the diagnostic accuracy of the PHQ-9 in primary care elderly. BMC Fam Pract. 2010 Sep 1;11:63
7. Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). JAMA. 2003 Jun 18;289(23):3095-105.
8. Daumit GL, Anthony CB, Ford DE, et al. Pattern of mortality in a sample of Maryland residents with severe mental illness. Psychiatry Res. 2010 Apr 30;176(2-3):242-5.
9. Maxwell M, Harris F, Hibberd C, et al. A qualitative study of primary care professionals' views of case finding for depression in patients with diabetes or coronary heart disease in the UK. BMC Fam Pract. 2013 Apr 4;14:46.
10. O'Connor EA, Whitlock EP, Beil TL, Gaynes BN. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Intern Med. 2009 Dec 1;151(11):793-803
11. Canadian Task Force on Preventive Health Care, Joffres M, Jaramillo A, Dickinson J, et al. Recommendations on screening for depression in adults. CMAJ. 2013 Jun 11;185(9):775-82
12. Thombs, Brett D., and Roy C. Ziegelstein. "Does depression screening improve depression outcomes in primary care?." BMJ: British Medical Journal 348 (2014).
13. Lawrence RS. Diffusion of the U.S. Preventive Services Task Force recommendations into practice. J Gen Intern Med. 1990 Sep-Oct;5(5 Suppl):S99-103.
14. Carpiano RM, Flocke SA, Frank SH, Stange KC. Tools, teamwork, and tenacity: an examination of family practice office system influences on preventive service delivery. Prev Med. 2003 Feb;36(2):131-40.
15. Centers for Medicare and Medicaid Services. Medicare Program; Payment Policies Under the Physician Fee Schedule and Other Revisions to Part B for CY 2011 November 29, 2010. Available at: https://www.federalregister.gov/articles/2010/11/29/2010-27969/medicare-program-payment-policies-under-the-physician-fee-schedule-and-other-revisions-to-part-b-for#h-117 Accessed July 10, 2013
16. American College of Physicians. Annual Wellness Visit to Provide Personalized Preventive Plan Benefit. Available at: http://www.acponline.org/running_practice/payment_coding/wellness.htm Accessed April 9, 2014
17. Medicare Learning Network: Quick Reference Information: the ABCs of Providing the Annual Wellness Visit. Available at: http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/AWV_Chart_ICN905706.pdf. Accessed November 6, 2012
18. Substance Abuse and Mental Health Services Administration. Older American Behavioral Health: Issues Brief 4. Preventing Suicide in Older Adults. Available at: http://www.aoa.gov/AoARoot/AoA_Programs/HPW/Behavioral/docs/Older%20Americans%20Issue%20Brief%204_Preventing%20Suicide_508.pdf Accessed August 27, 2013
19. Rubin RR, Ciechanowski P, Egede LE, Lin EH, Lustman PJ. Recognizing and treating depression in patients with diabetes. Curr Diab Rep. 2004 Apr;4(2):119-25.
20. Sinnige J, Braspenning J, Schellevis F, Stirbu-Wagner I, Westert G, Korevaar J. The prevalence of disease clusters in older adults with multiple chronic diseases - a systematic literature review. PLoS One. 2013 Nov 11;8(11):e79641.

21. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet. 2007 Sep 8;370(9590):851-8.
22. Chronic Condition Data Warehouse. Available at: www.ccwdata.org/web/guest/home. Accessed January 24,2014
23. STATA. Help for xtmelogit. Available at:www.stata.com/help.cgi?xtmelogit Accessed January 20, 2014
24. Fitzmaurice GM, Laird NM, Ward JH. Applied Longitudinal Analysis. Second Edition. Wiley.
25. Whitlock S. Essentials of the Medicare Annual Wellness Exam. Available at: http://www.fprr.org/wp-content/uploads/2013/02/Essentials-of-the-Medicare-Annual-Wellness-Exam-BP-Whitlock.pdf Accessed July 10, 2013.
26. Dowrick C, Leydon GM, McBride A, Howe A, Burgess H, Clarke P, Maisey S, Kendrick T. Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study.BMJ. 2009 Mar 19;338:b663
27. O'Connor EA, Whitlock EP, Gaynes B, et al. Screening for Depression in Adults and Older Adults in Primary Care: An Updated Systematic Review [Internet].Evidence Syntheses, No. 75. Rockville (MD): Agency for Healthcare Research and Quality (US); 2009 Dec.
28. Maxwell M, Harris F, Hibberd C, Donaghy E, Pratt R, Williams C, Morrison J, Gibb J, Watson P, Burton CA qualitative study of primary care professionals' views of case finding for depression in patients with diabetes or coronary heart disease in the UK.BMC Fam Pract. 2013 Apr 4;14:46
29. Wennberg JE.Practice variations and health care reform: connecting the dots.Health Aff (Millwood). 2004;Suppl Variation:VAR140-4.
30. Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. Ann Intern Med. 2003 Feb 18;138(4):273-87.
31. Chang ET, Rose DE, Yano EM, Wells KB, Metzger ME, Post EP, Lee ML, Rubenstein LV. Determinants of readiness for primary care-mental health integration (PC-MHI) in the VA Health Care System. J Gen Intern Med. 2013 Mar;28(3):353-62

Table 1. Demographics by PHQ-9 Screening Status on Index Visit				
	Total population n(%)	Patients with Depression Screen n=606 (%)	Patients without Depression Screen n=4246 (%)	P-value
Mean Age (SD; Range)	74 (6.9; 63-90)	75 (7.1; 63-90)	74 (6.9; 63-90)	0.005
Female	3041 (61)	373 (62)	2577 (61)	0.69
Caucasian African American Other race	3032 (62) 1598 (33) 222 (5)	182 (31) 418 (69) 6 (1)	2850 (67) 1180 (28) 216 (5)	<0.001
AWV Index Visit	2344 (48)	231 (10)	375 (15)	<0.001
Depression*	607 (13)	80 (13)	527 (12)	0.58

*Defined by ICD-9 diagnosis code in the EHR

Figure 1. Percent of Depression Screens Stratified by Index Visit Type and Site



*Sites with ≥100 patients are presented individually. Sites with <100 patients are grouped into the site "All others".

Table 2. Odds of Depression Screening During the Index Visit					
	No Clustering		Physician-Level Clustering#		Physician and Site Clustering†
Model	OR	AOR‡	OR	AOR‡	AOR‡
AWV visit (ref = non-AWV)	0.62** (0.52,0.74)	1.19 (0.98, 1.44)	1.28 (0.85, 1.93)	1.32 (0.87, 2.00)	1.33 (0.85, 2.09)
Female (ref =male)	1.04 (0.87, 1.23)	0.88 (0.73, 1.06)	1.24 (0.90, 1.72)	1.25 (0.90, 1.73)	1.14 (0.79, 1.63)
Age ≥ 75 years (ref = <75 years)	1.30** (1.10-1.54)	1.48** (1.23, 1.78)	1.30 (0.95, 1.79)	1.31 (0.95, 1.81)	1.42 (1.00, 2.02)
Black race (ref= White)	5.55** (4.60-6.69)	6.12** (5.01, 7.50)	0.95 (0.62, 1.46)	0.98 (0.64, 1.51)	1.08 (0.68, 1.49)
Other race (ref = White)	0.43* (0.19-0.99)	0.43* (0.19, 0.97)	0.33 (0.10, 1.07)	0.33 (0.10, 1.07)	0.44 (0.13, 1.53)

*p-value ≤0.05

**p-value ≤0.01

#The physician variance is 18.1%, 95%CI: 11.0, 29.7. The intraclass correlation is 0.85, 95%CI:0.77, 0.90.

†The physician variance is 11.3%, 95%CI: 2.5, 50.0; the site variance is 11.3%, 95%CI: 2.0, 64.6. The intraclass correlation for physician is 0.44 (95%CI:0.05, 0.91) and site is 0.87, 95%CI:0.78, 0.93).

‡ Model includes sex, age, and race

Table 3. Sensitivity Analysis: Odds of Depression Screening During the Index Visit with and without Site 34				
	No Clustering		Physician-Level Clustering	
Model	Only site 34‡ AOR	Excluding site 34‡ AOR	Only site 34‡ † AOR	Excluding site 34‡ †† AOR
AWV visit (ref = non-AWV)	0.75 (0.49, 1.13)	1.20 (0.80, 1.81)	0.56* (0.32, 0.97)	4.06** (2.09, 7.90)
Female (ref =male)	1.16 (0.76, 1.76)	1.10 (0.74, 1.64)	1.12 (0.72, 1.75)	1.60 (0.96, 1.65)
Age ≥ 75 years (ref = <75 years)	1.48 (0.96, 2.26)	1.34 (0.91, 1.98)	1.53 (0.97, 2.39)	1.00 (0.61, 1.62)
Black race (ref= White)	1.18 (0.71, 1.96)	0.54* (0.31, 0.95)	0.91 (0.51, 1.65)	0.96, (0.49, 1.89)
Other race (ref = White)	0.42 (0.09, 1.90)	0.15 (0.02, 1.06)	0.39 (0.07, 2.05)	0.18 (0.02, 1.42)

*p-value ≤0.05

**p-value ≤0.01

† The physician variance is 1.0%, 95%CI: 0.3, 3.4.

†† The physician variance is 8.5%, 95%CI: 4.4, 16.4.

‡ Model includes sex, age, and race

Depression screening in primary care: either with smoking-screening or not at all

Abstract

Background: Depression is a highly prevalent disease, for which there may be systematic under-use of screening due to different barriers for depression screening than other physical health screenings.

Objective: To delineate whether depression screening is conducted differently than other preventive care screenings (e.g. smoking status screening). Specifically, this analysis will identify: 1) the difference in frequency in which patients are screened for smoking versus depression screening; and 2) the association between patient-level and clinic factors and receipt of both screenings.

Methods: Secondary analysis of retrospectively collected electronic health record (EHR) data from 4,763 Medicare-patients in 34 primary care practices between 2010-2012. The relationship between three independent variables (e.g. having multimorbidity, history of stroke, and/or having depression) and receipt of depression and smoking screening was evaluated. Multilevel logistic regressions were conducted cross-sectionally for each independent variable at the patient's first visit. Longitudinal analysis was conducted using patients' first five visits in the study to obtain an estimate of the odds of screening over time.

Results: Fifty-percent of the patients were screened for smoking use at every visit but not depression (n=2378). Only one person was screened for depression and not smoking status. In the adjusted longitudinal analyses, having multimorbidity was associated with decreased odds of receiving both depression and smoking status screenings, compared to either

smoking status screening or no screen, by 28% after adjusting for race, age, and sex.(AOR: 0.72, 95%CI:0.52-1.0). The odds of receiving both screens, compared to either smoking status screenings or no screen, was not significant for patients with history of stroke or depression in the multivariable-adjusted analyses.

Conclusions: We found a consistent pattern of concurrent depression and smoking-screening. Additionally, we found that patients with multimorbidity had decreased odds of receiving both depression and smoking-status screening in the multivariable regression. This finding is not surprising given barriers found in earlier studies for depression screening, which may be amplified for patients with multimorbidity.

Introduction:

Depression is one of the most prevalent mental health diseases, affecting 1 in 6 older adults in the United States.[1,2] Medicare reimbursement for annual depression screening in primary care started in 2011.[3] A recent review found that 10% of patients in primary care may meet the criteria for major depressive disorder.[4] Yet, screening for depression is considered inadequate by many experts,[4] despite availability of validated tools for depression screening.[5] In order to increase depression screening, quality incentives are being implemented as part of Meaningful Use stage 2 (the second phase of the Centers for Medicare & Medicaid Services' incentive program for effective use of electronic health records (EHR)) for screening for depression and subsequent documentation of a clinical plan.[6]

A recent qualitative study of outpatient clinicians found that there may be a systematic under-use of depression screening.[7] Potential barriers from the clinicians' viewpoint include the assumption that assessing physical health should be done first, and concerns regarding the availability of follow-up care for patients who screen positive for depression.[7] This is particularly relevant since depression is known to co-occur with other diseases,[8] suggesting that the patients at highest risk for depression may have numerous health concerns competing for clinicians' time. For example, 16-40% of stroke patients experienced minor or major depression after a stroke,[9] which is much higher than base rates of depression.[10]

Receipt of preventive care screenings, such as depression, may be a function of how care is delivered in a particular clinic. Factors that are associated with guideline-consistent screening by a physician include access to an EHR, younger age, seeing fewer patients per week, and having a patient who prefers screening.[11] Particular clinicians and sites may conduct more preventive care screenings due to their structural capabilities.[12] However, it is

not well understood whether care structure affects screenings for mental (e.g. depression) and physical health (e.g. smoking) equally.

Smoking-status screening is a patient-reported preventive care screening, similar to depression screening, but it occurs much more often. As noted in HealthyPeople 2020 objectives, smoking status screening occurred in 62 percent of office-based ambulatory care setting visits in 2007[13] and only 2 percent of physicians screened adults for depression in 2007.[14] Importantly, physicians may not be the individuals actually conducting the screening; instead, it may be a nurse or medical assistant's responsibility.

Smoking status screening is a good comparator to depression screening. Both are screens of patient-reported outcomes. Positive screens on either may be indicative of a chronic condition that requires continued follow-up, and may require cognitive or behavioral therapy, and/or pharmacotherapy to achieve desired outcomes.[15] Rates of smoking and depression are similar in older adults.[16,17] Both smoking screening and depression-screening have been recommended by the U.S. Preventive Services Task Force.[18,19] However, the recommended follow-up for a positive screen is quite different--if a smoking status screen is positive then the physician can conduct a "brief counseling (3 minutes or less)".[18] If a depression screen is positive, a full diagnostic interview should occur.[19]

The objective of this study is to delineate whether depression screening is conducted differently than other preventive care screenings (e.g. smoking status screening). Specifically, this analysis will identify: 1) the difference in frequency in which patients receive smoking, depression, or both screens; 2) the association between patient-level factors and receipt of one or both screenings; and 3) the impact of clinic-level clustering on the association between patient-level factors and receipt of screenings.

It is hypothesized that depression screening may occur at a different frequency than smoking status screening, but to our knowledge, no study has empirically tested this

hypothesis. Understanding whether clinicians screen for smoking-use and overlook depression screening, when given the opportunity for preventive-care screening, is key to knowing whether there is a disparity in willingness to identify mental health conditions, especially with recent efforts to measure the quality of depression care.[6]

Methods

Study population

This is a secondary analysis of retrospectively collected EHR data from 5,000 Medicare-covered patients across 198 physicians working in 34 primary care practices in Maryland and Washington, D.C.. Physicians were Internal Medicine or Family Medicine specialists. For the purposes of the original study evaluating the Annual Wellness Visit (AWV), quota-random sampling was used so that half of the patients had at least one Annual Wellness Visit (AWV)[19] and half of the patients had a non-AWV primary care visit during the study period. In this analysis, patients' probability of being screened for depression and smoking status was compared to both the probability of receiving neither screen and the probability of only being screened for smoking status both cross-sectionally and longitudinally.

Data Collection

Clinicians within these practices used General Electronic Health's Centricity EHR system which was implemented in 2007. This EHR system was designed for ambulatory office settings and can interface with practice management systems.

Since patients' weight is routinely assessed at primary care visits, a body mass index (BMI) observation was used to mark whether a patient had a visit to any of the primary care practices between September 1, 2010 and August 31, 2012. BMI was collected from structured observation fields in the primary care practices' EHR system. BMI scores are

automatically calculated if the patient's height is in the EHR and the patient's weight is taken during the visit. Only the date of each BMI observation was used in this analysis. Five-percent of patients originally included in the study set (n=237) did not have any BMI score. These patients were excluded from the original population of 5,000 leaving a study population of 4,763 people.

Data on smoking screening also came from structured fields in the EHR. The smoking screening variable was defined based on whether a patient's smoking status was captured as a structured observation term (i.e., a checkbox) in the EHR. Patients were asked if they were a current smoker and their answer was recorded in the EHR in a structured form.

Depression screening was defined based on use of the patient heath questionnaire (PHQ), a validated patient-reported depression screening tool[5] specified for screening at the time of this study, captured as structured observation fields in the EHR. The template allowed clinicians or staff to ask the first two questions (the PHQ-2), regarding Diagnostic and Statistical Manual's (DSM-IV) two main symptoms of major depression (i.e., depressed mood and anhedonia), and then if the patient answered positively to one of these questions, continued to the longer PHQ-9 template.

Independent Variables

We selected three different types of key independent variables for the analysis based on a review of the literature, conceptual model of factors affecting screening, and data availability. The first variable is multimorbidity status, a marker for patient factors that could compete for time with screening for depression. For the second variable, we chose one unrelated significant illness associated with higher rates of depression which increases the importance of depression screening, history of stroke. The third is history or active depression, which increases the importance of screening.

We hypothesized that multimorbidity could be associated with higher or lower rates of depression screening. Multimorbidity is a risk factor for depression, which could increase the likelihood of screening;[21] yet, patients with multimorbidity may have competing interests for physicians' time, lowering the likelihood of depression screening. Multimorbidity was defined by 2 or more active diagnoses for common chronic conditions (hyperlipidemia, hypertension, rheumatoid arthritis, diabetes, ischemic heart disease, chronic kidney disease, depression, osteoporosis, chronic obstructive pulmonary disorder, cancer, asthma, atrial fibrillation, stroke, or heart failure) based on the patient's problem list.[22] The ICD-9 codes for categorizing comorbidities were obtained from the Chronic Disease Warehouse.[22]

Stroke was included as a second independent variable because after a stroke, a patient's risk for depression is between 16-40 percent.[9] Moreover, assessing the impact of screening for a single disease with a known risk for depression, compared to patients with multimorbidity, would reduce the heterogeneity of the population who would be positively coded for this independent variable. Individuals with a previous history of stroke (ICD-9 codes: 430, 431, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.00, 434.01, 434.10, 434.11, 434.90, 434.91, 435.0, 435.1, 435.3, 435.8, 435.9, 436, 997.02) were coded as "one" and patients with no history or stroke were coded as "zero".

Finally, physicians may screen for depression only if they already suspect depression, or to use as a way to assess depression remission. Therefore, depression status is being included as an independent variable with patients who have an active diagnosis of depression or previous diagnosis of depression with the problem list (ICD-9 codes 296.20, 296.21, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.31, 296.32, 296.33, 296.34, 296.35, 296.36, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.89, 298.0, 300.4, 309.1, 311) coded as "one". All others will be coded as "zero".

Dependent Variables

Screening status on each visit is the dependent variable. The visit date is based on having structured BMI observation for which smoking and depressions screens were matched by date. Cross-sectional analysis was conducted for the first visit since every patient had at least one visit. Longitudinal analysis, which allows for clustering by physician and site, was conducted for patients' first five visits.

For the cross-sectional analysis, each patient's first visit was defined as no-screen (e.g. neither a smoking or a depression screen on the date of the BMI observation); smoking screen only (e.g. a smoking screen on the same date as the BMI observation, but no depression screen); or both-screens (e.g. smoking and depression screen on the same date as the BMI observation). Only one patient had a depression screen without a smoking screen. Due to this small sample, receipt of a depression screen without a smoking status screen was not created as a dependent variable.

For the longitudinal analysis, the dependent variable was reported two ways. First, as the odds of having both a depression and smoking status screening versus having neither screen or only a smoking status screen. Second, as the odds of having both a depression and smoking status screening versus having only a smoking status screen. For each patient's first five visits, the visit was coded 1 if the patient received both screens and 0 otherwise. The benefit of longitudinal analysis is it accounts for the possibility a patient received both screens on a later visit, thereby limiting the possibility that the patient's initial visit was not an opportunity for screening. Previous work has demonstrated that taking into account at least four visits provides stable estimates of preventive care screening.[23]

Covariates

Patient-level demographic variables (age, race, sex) were included as covariates in the adjusted models. Age was included as a continuous variable. Race was included as a categorical variable with white being the reference group compared to black or other race.

Analysis

For each visit, the percent of patients who had no screen at that visit, either a smoking screen or a depression screen, or both screens was reported for up to the patient's 15th visit. For patients who had only 1 visit, only 2 visits, only 3 visits, only 4 visits, or greater than or equal to 5 visits, the number of screens per visit up to five visits was also reported to provide a description of how having more opportunities for screening affects the number and type of screens at each visit. Fisher's exact test was used to compare receipt of screening on the first visit for people who had less that 5 visits compared to patients with equal to or greater than 5 visits.

Multilevel logistic regressions were run for the cross-sectional analysis to identify the effect of each independent variable (multimorbidity, history of stroke and history of depression) on the odds of screening during the first visit. Five logistic models were run for each independent variable: no screening versus any screening; no screening versus both smoking and depression screening; smoking screening alone versus no screening; smoking screening alone versus both smoking and depression screening; and no screening or smoking screening alone versus both smoking and depression screening. Site clustering was accounted for using hierarchical models since there is a effect of clinic site on screening practices. (Figure 1) Output for all models is reported both as unadjusted and adjusted (for age, race and sex) odds-ratios.

Six longitudinal logistic regressions were conducted using each of the independent variables: multimorbidity, history of stroke and history of depression. Longitudinal analysis allowed assessment of whether the odds of having both smoking and depression screening

compared to the odds of having either no screen or only a smoking screen was impacted by the number visits. A second analysis compared the odds of having both smoking and depression screening compared to the odds of having smoking screening alone. Longitudinal analysis allows for a more stable estimate of patient's odds of screening since more than one visit is included in the analysis. Further, conducting both sets of regressions allows an evaluation of the impact of excluding patients with no screening from the analysis. The longitudinal analysis included screens during a patient's first 5 visits in the study. Age, sex and race were included as covariates in all of the regressions. Standard errors for all regressions were clustered by patient and clinic site using multilevel modeling.

Stata 12.0 was used to conduct all analysis. Institutional review board approval was received from Johns Hopkins Bloomberg School of Public Health Review Board.

Results

The majority of patients in the study were white (63%; n=3,002) and the mean age was 74 years. The number of visits ranged from only one visit (n=579 people) to thirty visits (n=6 people), with the overall average number of visits being 5 (SD: 3.4). In total, 581 patients only had 1 visit; 672 only had 2 visits; 585 only had 3 visits; 570 only had 4 visits; and 2,351 patients had 5 or more visits.

Almost all patients were screened for smoking or depression during at least one visit. When looking at the extremes, eighty-nine individuals (2%) were never screened for smoking or depression and 226 individuals (5%) were always screened. Fifty-percent of the patients were screened for smoking use at every visit but not depression (n=2,378). Only one person was screened for depression and not smoking status. Table 1 presents the demographic characteristics of the population by overall proportion of screens.

As seen in figure 2, the majority of individuals were screened only for smoking during any given visit. There was a statistically significant difference in the number of screens received on the first visit by patients with less than 5 visits compared to patients with greater than or equal to 5 visits ($p<0.01$). Further, 12% of patients with at least five visits received both depression and smoking-status screens on each of their first five visits. In comparison, 5% of patients with four visits received a depression and smoking-status screen on each of their four visits.

Presented in figure 1 is the percentage of depression and smoking screens for each visit by site. There is a site effect with site 34 screening the majority of their patients (~87%) for both depression and smoking-status at each visit. Conversely, site 25 screens 93% of patients for smoking alone on the first visit; and 53% of patients for smoking alone on their second visit. Patients are not screened for depression during either visit.

Cross-sectional analysis

The adjusted and unadjusted odds of screening during the first visit, after accounting for clinic-level clustering, was determined. Adjusting for age, race and sex did not impact the odds considerably for any comparison. Patients with depression had significantly lower odds of receiving both a depression and smoking status screen compared to receiving no screening, after adjusting for age, race and sex (AOR: 0.44, 95%CI:0.23-0.93). Patients with a history of stroke had significantly higher odds of receiving a smoking status screening compared to no screening, after adjusting for age, race and sex (AOR: 1.58, 95%CI: 1.09-2.28). However, patients with stroke had lower odds of receiving any screening (either smoking screening alone or both smoking and depression screening) compared to no screening after adjusting for age, sex, and race(AOR:0.63, 95%CI:0.44-0.91). Having multimorbidity did not change the odds of screening for any comparison. (Table 2)

Longitudinal analyses

In the adjusted longitudinal analyses, having multimorbidity was associated with decreased odds of receiving both depression and smoking status screenings compared to either smoking status screenings or no screening by 28% after adjusting for race, age, and sex.(AOR: 0.72, 95%CI:0.52-1.0). The odds of receiving both screens, compared to either smoking status screenings or no screen, was not significant for patients with history of stroke or depression in the multivariable-adjusted analyses.

Approximately 3% (95%CI:1.9-4.3) of the variance in the screening was attributable to differences across patients, and 12% (95%CI:8.4-16.7) was attributable to differences across sites for patients with a history of stroke. However, the variance among sites was smaller when calculating the odds of receiving both screens compared to no screen or smoking status screening only for patients with depression compared to patients without depression (3%, 95%CI: 2.0-4.3 between patients and 5%, 95%CI:3.8-7.1 between sites). (Table 3)

There was no change in odds of being screened for both depression and smoking status compared to being screened for smoking alone for patients with multimorbidity, depression, or history of stroke.(Table 3)

Discussion

In our analysis, we found that a majority of patients were screened for smoking status at every visit, but very few patients were being screened for depression, and almost none were screened for depression alone. Depression screening was occurring concurrently with smoking status screening, and this pattern was stronger among patients with greater numbers of visits in the study. In the cross-sectional multilevel logistic analysis, adjusting for age, sex, and race did not greatly impact the odds of screening for any of the outcomes. Patients with a history of stroke had significantly higher odds of receiving no screening

compared to receiving any screening (e.g. both smoking and depression screening or smoking alone) (AOR: 0.63) after adjusting for age, sex, and race. Of note, patients with depression had 66% higher odds of receiving no screening compared to receiving both depression and smoking screening (AOR:0.44) Neither having multimorbidity, nor history of stroke, significantly increased the odds of receiving both depression and smoking screening compared to either no screening or smoking screening alone on the first visit.

In longitudinal model accounting for clustering within patient and site, the impact of having a history of stroke or depression on the odds of receiving screening was eliminated. Interestingly, the odds of patients with multimorbidity receiving neither screen or only a smoking status screen compared to both screens was 18% higher (AOR: 0.72; 95%CI: 0.52, 1.0). While this finding was barely significant, patients with multimorbidity may experience more intractable barriers to depression screening over time.

Conducting multiple preventive-care screenings at the same time, such as during an annual exam, is advocated as a good way to provide health care. Annual physical exams, which are an ideal time for concurrent preventive-care screenings, improve both patient-physician relationships and detection of subclinical illness.[24] Our study found a strong presence of concurrent screening for smoking status and depression, suggesting that depression screening often occurs along with smoking status screening. Yet, it may be difficult for physicians to administer all of the guideline-recommended preventive care screening due to time constraints, concern about harms associated with care, and patient preferences, especially for patients with multimorbidity.[25] Depression screening may strengthen these concerns due to stigma associated with depression diagnoses for patients,[26] concerns about the impact of screening on the patient-physician relationship,[26] and the considerable time required in follow-up if a depression screen is positive.[19] Especially since there is good evidence for the positive effects of 3-minute counseling for tobacco-users,[18]

and there is no short intervention for patients with depression that has been shown to improve outcomes.

Patients who accessed care more often were screened with greater frequency for both depression and smoking status. Nearly 90% of patients were screened for smoking during any given visit in the study, which may have been a result of initiatives to screen for smoking at every visit.[27,28] Screening for depression at every visit may be inefficient care, but never screening for depression is not optimal either. Especially for patients with multimorbidity, since depression commonly occurs alongside other chronic diseases.[29] Solutions for screening at timely intervals may involve clinical decision support for preventive care screening; though, a more comprehensive intervention than implementing an EHR may be required to improve care quality.[30] The strong site effect is suggestive that site-specific workflow is a major factor in how often preventive screening occurs.

Other studies have found that quality of care measures for depression may have different facilitators than measures for physical health. For example, Friedberg and colleagues found that none of the structural capabilities measured among primary care practices (patient assistance, EHRs, a culture of quality, or enhanced access) were associated with increased HEDIS depression quality measure completion rates, but they were associated with measures of physical health care.[12] On-site language interpreters were the exception which significantly increased the adjusted probability of completion of the HEDIS depression quality measure.[12]

Our paper has several limitations. Our study only assessed screening in Medicare patients in 34 practices across one state, limiting the generalizability of this study. Further, we assessed the likelihood of depression screening for patients with multimorbidity, stroke, and depression. The likelihood of depression screening may be different for different populations of patients. Finally, this was a retrospective analysis, and not all patients had the

same number of visits within the study period. Therefore, there is risk of bias that the patients who had less visits may have had less opportunity for depression screening. We attempted to control for this in the analysis by comparing depression screening to smoking status screening with the assumption that screening for smoking status and depression should be similar since the prevalence of depression is similar, or greater than smoking status among older adults.[16,17] Finally, we are unable to determine how the depression or smoking status screen was administered in the clinics.

Conclusion

While differences in depression and smoking status screening were anticipated, the consistent pattern of concurrent depression and smoking-screening was not. We found that depression screening is rarely conducted in isolation. Patients with multimorbidity had decreased odds of receiving both depression screening and smoking-screening in the adjusted longitudinal regression which accounted for patient and site clustering. This finding is not surprising given barriers found in earlier studies for depression screening, which may be amplified for patients with multimorbidity.[25,26] Variation in depression screening by site may be due to lack of clear guidelines on when to screen for depression resulting in an "often" or "never" approach by clinics. Clinic proclivity for preventive-care screening clearly impacted how often a patient was screened. The efficiency of different clinic workflows for preventive-care screening should be considered especially when trying to meet depression quality of care indicators.

References

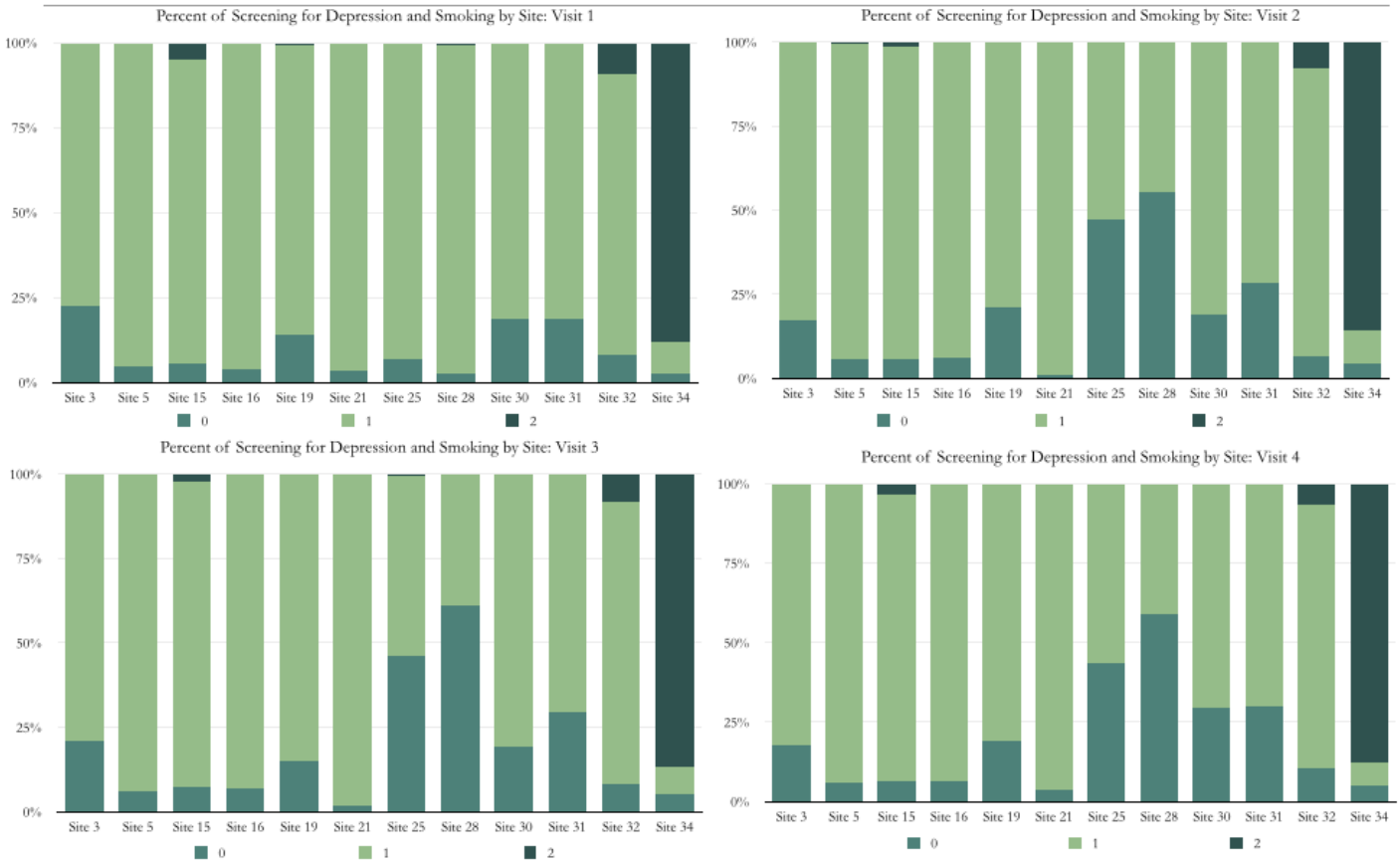
1. National Institute of Mental Health. Older Adults: Depression and Suicide Facts (Fact Sheet). Available at: http://www.nimh.nih.gov/health/publications/older-adults-depression-and-suicide-facts-fact-sheet/index.shtml. Accessed May 6, 2013.
2. Centers for Medicare and Medicaid. Decision Memo for Screening for Depression in Adults (CAG-00425N). Available at: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=251#_ftn5. Accessed May 2, 2013.
3. Centers for Medicare and Medicaid. Decision Memo for Screening for Depression in Adults (CAG-00425N). Available at: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=251#_ftn5. Accessed May 2, 2013.
4. Craven MA1, Bland R. Depression in primary care: current and future challenges. Can J Psychiatry. 2013 Aug;58(8):442-8.
5. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a Brief Depression Severity Measure. J Gen Intern Med. 2001 Sep;16(9):606-13.
6. Centers for Medicare and Medicaid. Additional Information Regarding EP Clinical Quality Measures for 2014 EHR Incentives Programs. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/EP_MeasuresTable_Posting_CQMs.pdf. Accessed May 17, 2013
7. Maxwell M, Harris F, Hibberd C, et al. A qualitative study of primary care professionals' views of case finding for depression in patients with diabetes or coronary heart disease in the UK. BMC Fam Pract. 2013 Apr 4;14:46. doi: 10.1186/1471-2296-14-46.
8. Phelan E, Williams B, Meeker K, et al. A study of the diagnostic accuracy of the PHQ-9 in primary care elderly. BMC Fam Pract. 2010 Sep 1;11:63
9. Narushima K, Robinson RG. Stroke-related depression. Current Atherosclerosis Reports. 2002, Volume 4, Issue 4, pp 296-303.
10. Beekman, A. T. F., et al. "Depression in survivors of stroke: a community-based study of prevalence, risk factors and consequences." Social psychiatry and psychiatric epidemiology 33.10 (1998): 463-470
11. Yabroff KR, Klabunde CN, Yuan G, et al. Are physicians' recommendations for colorectal cancer screening guideline-consistent? J Gen Intern Med. 2011 Feb;26(2):177-84.
12. Friedberg MW, Schneider EC, Rosenthal MB, Volpp KG, Werner RM. Association between participation in a multipayer medical home intervention and changes in quality, utilization, and costs of care. JAMA. 2014 Feb 26;311(8):815-25.
13. U.S. Department of Health and Human Services. HealthyPeople2020:Smoking Use. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=41 Accessed March 20, 2014
14. U.S. Department of Health and Human Services. HealthyPeople2020: Mental Health and Mental Disorders. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=28. Accessed May 2, 2013.
15. Mory SS. American Family Physician. PHS Updates Smoking Cessation Guideline. 2001. Available at: http://www.aafp.org/afp/2001/0415/p1635.html Accessed March 20, 2014
16. Substance Abuse and Mental Health Services Administration, Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-46, HHS Publication No. (SMA) 13-4795. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2013. Available at: http://www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/NationalFindings/NSDUHresults2012.htm#ch4.1 Accessed March 18, 2014
17. Rodda J, Walker Z, and Carter J. Depression in older adults. BMJ 2011: 343
18. U.S. Preventative Services Task Force. Counseling and Interventions to Prevent Smoking Use and Smoking-Caused Disease in Adults and Pregnant Women: Reaffirmation Statement. 2009. Available at: http://www.uspreventiveservicestaskforce.org/uspstf09/tobacco/tobaccors2.htm Accessed April 3, 2014

19. U.S. Preventative Services Task Force. Screening for Depression in Adults. 2009. Available at: http://www.uspreventiveservicestaskforce.org/uspstf/uspsaddepr.htm Accessed April 3, 2014
20. Medicare Learning Network: Quick Reference Information: the ABCs of Providing the Annual Wellness Visit. Available at: http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/AWV_Chart_ICN905706.pdf. Accessed November 6, 2012
21. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet. 2007 Sep 8;370(9590):851-8.
22. Chronic Condition Data Warehouse. Available at: www.ccwdata.org/web/guest/home. Accessed January 24,2014
23. Bentley TG, Malin J, Longino S, Asch S, Dy S, Lorenz KA. Methods for improving efficiency in quality measurement: the example of pain screening.Int J Qual Health Care. 2011 Dec;23(6):657-63
24. Prochazka AV, Lundahl K, Pearson W, Oboler SK, Anderson RJ. Support of evidence-based guidelines for the annual physical examination: a survey of primary care providers. Arch Intern Med. 2005 Jun 27;165(12):1347-52.
25. Fried TR, Tinetti ME, Iannone L. Primary care clinicians' experiences with treatment decision making for older persons with multiple conditions. Arch Intern Med. 2011 Jan 10;171(1):75-80.
26. Dowrick C,Leydon GM, McBride A, Howe A, Burgess H, Clarke P, Maisey S, Kendrick T. Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study.BMJ. 2009 Mar 19;338:b663
27. The Agency for Health Care Policy and Research Smoking Cessation Clinical Practice Guideline. JAMA. 1996 Apr 24;275(16):1270-80.
28. Agency for Healthcare Research and Quality. 5 Major Steps for Intervention. Available at: http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/tobacco/5steps.html. Accessed March 20, 2014
29. Sinnige J, Braspenning J, Schellevis F, Stirbu-Wagner I, Westert G, Korevaar J. The prevalence of disease clusters in older adults with multiple chronic diseases--a systematic literature review. PLoS One. 2013 Nov 11;8(11):e79641.
30. Romano MJ, Stafford SS. "Electronic health records and clinical decision support systems: impact on national ambulatory care quality." Archives of Internal Medicine 171.10 (2011): 897-903.

Table 1. Demographic Characteristics by overall proportion of screenings				
	Patients with no screenings always (n=89) (%)	Patients with only smoking screening (n=2378) (%)	Patients with both screening always (n=226) (%)	Patients with mix of smoking and depression screening (n=2069) (%)
Mean age	75 (7.4; 64-90)	73 (6.8; 63-98)	74.4 (7.2; 63-94)	74 (6.9; 63-96)
Female	47 (53)	1400 (59)	125 (55)	1331 (64)
White Black Other	47 (53) 37 (42) 5 (6)	1777 (75) 470 (20) 131 (6)	58 (26) 167 (74) 1 (0)	1119 (54) 875 (42) 75 (4)
Multimorbidity = yes	59 (66)	1403 (59)	158 (70)	1527 (74)
Stroke = yes	7 (8)	113 (5)	8 (4)	151 (7)
Depression = yes	11 (12)	295 (12)	25 (11)	337 (16)

#Only one patient had a depression screen and no smoking screen

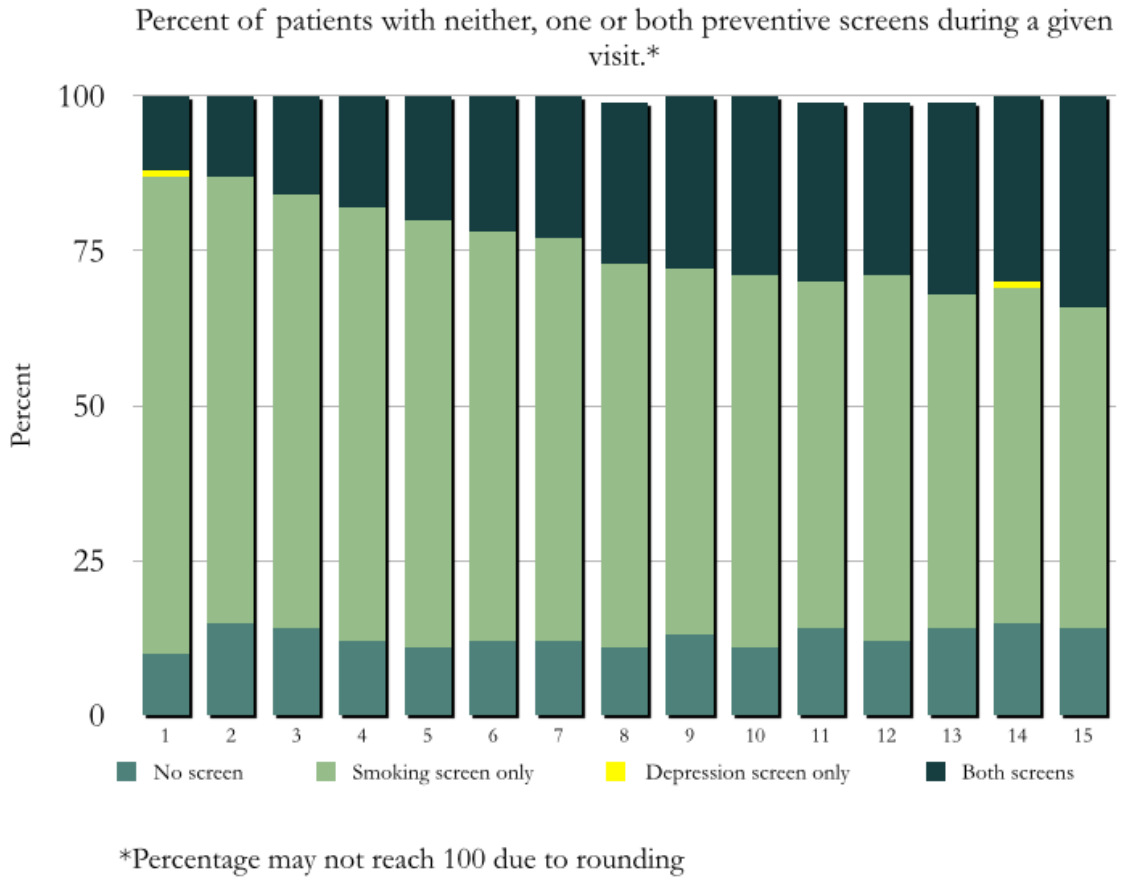
Figure 1. Percent of screening for depression and smoking by clinic site* for visits 1-4.



Key: 0 = no screening during that visit; 1 = only smoking screening during that visit; 2= both smoking and depression screening during that visit.

*Only sites with ≥100 patients are shown to limit selection bias

Figure 2.



*Percentage may not reach 100 due to rounding

Table 2. Cross-sectional analysis: Impact of Multimorbidity, History of Stroke and Depression on receipt of smoking and depression screening when accounting for site clustering					
		Unadjusted Model		Adjusted for Age, Race & Sex	
IV	Comparison*	OR (95%CI)	P-value	OR (95%CI)	P-value
Having multimorbidity	Smoking screening alone or both depression and smoking screening (ref = no screening)	0.80 (0.63-1.02)	0.07	0.82 (0.64-1.05)	0.11
	Both depression and smoking screening (ref = no screening)	0.67 (0.37-1.19)	0.17	0.62 (0.34-1.13)	0.12
	No screening (ref = smoking screening)	1.26 (0.99-1.60)	0.06	1.22 (0.95-1.55)	0.12
	Both depression and smoking screening (ref = smoking screening alone)	0.89 (0.61-1.31)	0.56	0.83 (0.56-1.22)	0.34
	Both depression and smoking screening (ref = no screening or both screens)	0.85 (0.59-1.24)	0.41	0.79 (0.54-1.15)	0.22
History of stroke	Smoking screening alone or both depression and smoking screening (ref = no screening)	0.62 (0.43-0.89)	0.01	0.63 (0.44-0.91)	0.01
	Both depression and smoking screening (ref = no screening)	1.74 (0.59-5.10)	0.31	1.56 (0.53-4.56)	0.42
	No screening (ref = smoking screening)	1.63 (1.13-2.35)	0.01	1.58 (1.09-2.28)	0.02
	Both depression and smoking screening (ref = smoking screening alone)	1.09 (0.56-2.11)	0.81	1.01 (0.52-1.97	0.97
	Both depression and smoking screening (ref = no screening or both screens)	1.10 (0.58-2.07)	0.78	1.02 (0.54-1.91)	0.96
Having depression	Smoking screening alone or both depression and smoking screening (ref = no screening)	0.86 (0.65-1.13)	0.28	0.86 (0.65-1.15)	0.31
	Both depression and smoking screening (ref = no screening)	0.45 (0.22-0.94)	0.03	0.44 (0.21-0.93)	0.03
	No screening (ref = smoking screening)	1.14 (0.86-1.51)	0.37	1.13 (0.85-1.50)	0.40
	Both depression and smoking screening (ref = smoking screening alone)	0.65 (0.40-1.05)	0.08	0.68 (0.41-1.11)	0.13
	Both depression and smoking screening (ref = no screening or both screens)	0.61 (0.38-0.97)	0.04	0.64 (0.40-1.03)	0.07

N's: Sample size for each comparison varies. No screening versus any screening n=4734; No screening versus both screens n= 1099; Smoking screening alone versus no screening n= 4109; Smoking screening versus both screening n= 4260; No screening or smoking screening versus both screens n=4734.

Table 3. Longitudinal analysis: Impact of Multimorbidity, History of Stroke and Depression on receipt of smoking and depression screening				
Predictor	Outcome	Odds*	95%CI	P-value
Having multimorbidity	Odds of having both screens (ref = neither screen or smoking)	0.72	0.52 -1.0	0.05
	Odds of having both screens (ref = smoking screen only)	0.82	0.57-1.18	0.280
History of stroke	Odds of having both screens (ref = neither screen or smoking)	1.16	0.68-1.97	0.58
	Odds of having both screens (ref = smoking screen only)	1.20	0.66-2.18	0.552
Having depression	Odds of having both screens (ref = neither screen or smoking)	0.73	0.49-1.08	0.12
	Odds of having both screens (ref = smoking screen only)	0.73	0.47-1.13	0.161

*Adjusted for Sex, Age, Race, and clustering within patient and clinic site

Depression Process of Care Completion Rates Among Medicare Part B Beneficiaries

Abstract

Background: Depression, a common mental health condition, often remains underdiagnosed and undertreated. New quality indicators are being developed to increase identification and appropriate management of depression in primary care.

Objective: To identify the prevalence and correlates of depression screening associated with quality measures and patient correlates of meeting quality indicators.

Methods: Secondary-analysis of retrospectively collected electronic health record data for 5,000 Medicare patients. Quality of depression care measures were identified in 2013 using databases which have a rigorous process of reviewing measures. Seven measures were found for which all the necessary information was available to compile that quality measure: general screening; depression management; depression reassessment; screening after stroke; screening after heart disease; depression reduction; and, depression remission. Assessment of completion of the seven quality indicators was determined based on the denominator and numerator specifications of each measure. Bivariate and multivariable logistic regression analysis was used to determine the predictors of meeting quality indicators based on patient's age, sex, race and whether he/she had an Annual Wellness Visit(AWV). Standard errors in the regressions were clustered by physician or site.

Results: Screening for depression among Medicare patients was low, at 17%. Performance on quality measures was generally low, varying from 10% for the screening for depression reduction measure to 77% for the depression remission at 12 months measure. In the multivariable model, controlling for clustering, patients older than 75 years were 41% more

likely to meet the general depression screening measure (AOR:1.41; 95%CI: 1.05-1.90). Patients with an AWV compared to patients without an AWV had an adjusted odds ratio of 3.93 for meeting the depression reduction measure after accounting for age, race, sex and site clustering (95%CI: 1.46-10.57).

Conclusions: Only a small proportion of Medicare patients received the recommended screening and follow-up care needed to meet the quality measures for depression monitoring and follow-up. There was no consistent patient characteristic that was correlated with screening on all measures. Further evaluation and validation of measures of depression care quality should be conducted before these measures are implemented widely.

Introduction

Depression is a common mental health condition that is a major cause of total years-lived with disability world-wide.[1-4] Nevertheless, depression often remains underdiagnosed and undertreated. Depressed older adults have poorer functional status[5] and utilize more health care than non-depressed older adults.[6] Older-adults are also at increased risk for suicide compared to the general population, an adverse outcome that is mainly attributable to depression.[7] The costs and disability associated with depression makes identifying patients with this illness and providing appropriate treatment an important goal. Older adults are often treated for depression in primary care as opposed to speciality care.[4] Indeed, in 2011, Medicare initiated coverage of one depression screen per year for Part B beneficiaries as part of the Annual Wellness Visit.[8]

Depression screening in primary care is currently being incorporated as quality of care indicator through different policy initiatives.[9-12] Through quality indicators, physicians are being asked to screen various types of patients for depression, including the general population,[11] patients previously diagnosed with depression to monitor symptoms,[14] and patients at higher risk for depression (e.g. patients with a history of stroke).[15] Quality initiatives such as screening for depression are likely to increase in coming years due to both the increasing focus on mental health care and the relative ease of collecting structured process measures from electronic health records (EHRs). For example, screening for clinical depression is included in the 2014 Adult Clinical Quality Core Measure for meaningful use incentives.[16] However, the "optimum frequency" of depression screening is unknown.[12,17]

A better understanding of completion rates of depression screening and correlates of such screening in Medicare patients would have important implications for policy makers as they decide on quality measures to adopt for pay-for-quality incentives.[18] In particular, information on the number of individuals who would be affected by these quality indicators

can provide useful guidance regarding the population impact of these interventions. To our knowledge, there is no current information on either depression screening rates as a preventive measure, or as a measure for monitoring depression in Medicare patients in the peer-reviewed literature. Therefore, the objective of this study is to identify the prevalence and correlates of depression screening associated with quality measures and patient correlates of meeting the quality indicator.

Methods

Study population

This report is based on the secondary-analysis of retrospectively collected EHR data for 5,000 patients across 198 physicians working in 34 primary care practices in Maryland and Washington, D.C.. Physicians were Internal Medicine or Family Medicine specialists. For the main study, quota-random sampling was required for drawing the sample so that half of the patients had at an Annual Wellness Visit (AWV) and half did not have an AWV primary care visit during the study period (September 1, 2010- August 31, 2012). AWV's are a recently implemented annual preventive care visit for Medicare beneficiaries covering 14 recommended preventive-care screenings, including a required depression screening during the patient's initial AWV.[19-21] For this study, having an AWV is included as a variable in the analysis to take advantage of this unique opportunity for understanding the impact of policy initiatives to increase depression screening on meeting quality indicators.

Data Collection

Clinicians used General Electronic Health's Centricity EHR system implemented in 2007. This EHR system was designed for ambulatory office settings and can interface with practice management systems. Scores from the Patient Heath Questionnaire (PHQ) screening instrument were collected from structured fields in the EHR. The structured

fields allowed physicians to answer the first two questions (the PHQ-2), regarding Diagnostic and Statistical Manual's (DSM-IV) two main symptoms of major depression (i.e., depressed mood and/or anhedonia), and if the patient answered positively to any one of these questions, continued on to the longer PHQ-9 template. In this manner, structured scores for both the PHQ-2 and the PHQ-9 were captured. For purposes of simplicity, the rest of the manuscript will refer to both version of the questionnaire as the PHQ-9. Data on all PHQ-9 screens was collected between July 1, 2009 and November 30, 2012 if a patient was selected into the study by having an index visit between September 1, 2010 and August 31, 2012. The patient's AWV or preventive care visit that was used to determine eligibility to be part of the parent study was identified as the patient's index visit for this study.

The PHQ-9 is a valid and reliable instrument for depression screening (sensitivity 88%, specificity 88% for major depression in a general population) commonly used in general medical settings.[22] A score greater than 5 is considered evidence of mild depression, greater than 9 as moderate depression and greater than 15 as moderately severe depression.[22]

Patient-level covariates included demographics (age, race, sex) and the patient's active diagnosis as recorded by the provider. Diagnosis was obtained from the patient's full problem list, and determined to be active if the diagnosis date was prior to the index date and either there was no stop date or the stop date was after the index date. Diagnoses were based on ICD-9 code definitions from the Medicare Chronic Conditions Data Warehouse.[23] Patients with two or more common chronic conditions (hyperlipidemia, hypertension, rheumatoid arthritis, diabetes, ischemic heart disease, chronic kidney disease, depression, osteoporosis, chronic obstructive pulmonary disorder, cancer, asthma, atrial fibrillation, stroke, or heart failure) were defined as having multimorbidity. Exclusion criteria for

measures depression screening within a 4-month period[24] and depression remission within a year[14] were calculated using ICD-9 codes 296.7, 296.80 and 296.00 from the problem list.

Patients with depression were identified using the following ICD-9 codes: 296.21, 296.22, 296.23, 296.30, 296.31, 296.31, 296.32, 296.33, 296.35, and 311.

Quality Indicators

Quality of depression care measures were identified in 2013 using the following databases, all of which have a rigorous process of reviewing measures for inclusion based on criteria such as importance and scientific soundness: National Quality Forum, Agency for Healthcare Research and Quality National Quality Measures Clearinghouse, Physician Quality Reporting System, and Electronic Health Record incentive program (Meaningful Use Stage 2). Measures were included if our data set contained all the necessary information to compile that quality measure.

The overall rate of general screening for depression and six quality measures were calculated. The specific measures were: the percent of patients with a diagnosis of major depression who had a depression screen at least once during a 4-month measurement period ("Depression management: screening within 4 months");[24] percent of patients with a new diagnosis of depression whose symptoms were reassessed by the use of a quantitative symptom assessment tool (such as PHQ-9) within three months of initiating treatment ("Depression reassessment: screening within 3 months of treatment");[25] percent of patients seen after a stroke who had a depression screen ("Screening after stroke");[15] and percent of patients with cardiovascular disease with documentation of screening for depression ("Screening after heart disease");[26] percent of patients with major depression or dysthymia or a PHQ-9 screen greater than 10 on the index visit, who had a 50 percent or greater reduction on their next PHQ-9 screen ("Screening for depression reduction");[13] and percent of patients with major depression or dysthymia and a PHQ-9 screen score greater than 9 on

the index visit, who achieved remission at twelve months as demonstrated by a twelve month (+/- 30 days) PHQ-9 score of less than five("Screening for depression remission").[14] (Table 1)

Analysis

Descriptive analysis was conducted to assess the percentage of patients who were screened for depression and summary statistics (e.g. mean, range).

Assessment of completion of the seven quality indicators was based on the denominator and numerator specifications of each measure. Three different periods (December 2010-February 2011; March 2011-June 2011; April 2012-August, 2012) were calculated to assess the sensitivity of the results to variations in time period for the measure "depression screening within 4 months".[24] Since the results were similar across all time periods, the March-June 2011 results are reported.

To determine correlates of meeting the measure's numerator, multilevel logistic regressions were run for measures that had more than 100 patients in the denominator. Patient covariates were included as dichotomous variables: male versus female; 65 to 74 years of age versus greater than or equal to 75 years; and non-AWV index visit versus AWV-index visit. Race was categorized into three large categories: white, black or other. White race was set as the reference category since it was the largest. Multilevel regressions were run with the standard errors clustered first by the physician, and then by the site. However, since the results were similar, only clustering by site is shown.

Multivariable logistic regression analysis was used to determine the predictors of meeting quality indicators for the measures that had more than 100 patients in the denominator. Standard errors were clustered by site for the multivariable logistic regression since clustering by site provided slightly better estimates in the bivariate analysis. All results are reported out as adjusted odds-ratios (AOR).

Results

Patients who were sampled were on average 74 years old, 63% were white, 61% were female, and 48% had at least one AWV during the study period. In sum, 705 individuals (14%) had a diagnosis of depression within the study period. Of these individuals, 7 had a co-occurring diagnosis for bipolar disorder.

General Screening

In total, 869 people (17%) of patients had at least one PHQ-9 score recorded in the EHR, of which 69% (n=603) had a maximum score of zero, indicating no depressive symptoms. A small percentage of patients scored greater than 5 on any screen, an indication of at least having moderate depression symptoms (n=92; 11%). Very few patients (n=47; 5%) had a PHQ-9 score greater than 10 on any screen.

Persons who were screened at least once for depression, were likely to be screened more than once. Eighty-two percent of patients screened had a second screen (n=716). Seventy-eight percent of patients who had at least one screen had a subsequent screen within one year of the index visit. Likelihood of a subsequent screen differed significantly by visit type, with a higher percentage of non-AWV patients receiving a follow-up screen (93 percent compared to 63 percent).

Depression management: screening within 4 months

A total of 698 patients with a diagnosis of depression and no diagnosis of bipolar disease were included in this analysis. Overall, 69 (10%) of these individuals had at least one depression screen during the study period.

Depression reassessment: screening within 3 months of treatment

Two-hundred and seventy-five patients who had a clinical diagnosis of depression within one year of their index visit were included in the assessment for this indicator. Of these, 42 (15%) of newly diagnosed patients had a depression screen within 3 months (90 days) of their diagnosis.

Screening after stroke

Three-hundred and three (6%) patients with a clinical diagnosis of stroke were included in assessment of this quality indicator. Of these, 64 patients (21%) had a depression screen.

Screening after heart disease

Two-hundred and fifty-nine (5%) patients had a clinical diagnosis for heart disease. Of these, 49 patients (21%) had a depression screen.

Screening for depression reduction

In total, 667 patients (13%) either had a diagnosis of depression on or prior to the index visit, or had a PHQ-9 screen greater than 10 on their index visit. Of these patients, 68 (10%) had a 50 percent reduction in a subsequent PHQ-9 score during the study period. Of the few patients (n=9) that had a PHQ-9 screen greater than 10 on the index visit, two had a reduction of 50% on their subsequent screen.

Depression remission at 12 months

Forty-seven patients had a PHQ-9 score greater than 10 during the study period. Of which, 30 patients also had a diagnosis of depression. Twenty-three patients (77%) of the 30 met the quality indicator criterion of a subsequent depression score less than 5 within 12 months of the initial PHQ-9 score greater than 10.

Correlates of meeting quality indicators

Correlates of meeting different quality measures varied by measure. In the unadjusted regressions, black patients were consistently more likely to meet quality measures

compared to whites even when controlling for site clustering. However, this trend was only significant for the depression management, depression reassessment and screening after heart disease measures(AOR: 2.63, 95%CI: 1.15-6.00; AOR:4.11, 95%CI:1.17-14.48; and AOR:5.23,95%CI:1.35-2.00, respectively). Further, the odds of black patients meeting the quality measure more than white patients held in the multivariable model for both the depression reassessment and screening after heart disease models (AOR: 4.19; 95%CI: 1.16-15.19; AOR:5.57, 95%CI:1.37-22.57).

Having an AWV visit increased the odds of meeting the depression reduction measure. In the multivariable model, patients with an AWV compared to patients without an AWV had an adjusted odds ratio of 3.93 for meeting the depression reduction measure after accounting for age, race, sex and site clustering (95%CI: 1.46-10.57). However, having an AWV did not significantly change the odds of meeting any other quality measure in the multivariable models; and it decreased the odds of depression screening in the bivariate model for the general depression measure (OR:0.42, 95%CI:0.31-0.58).

In the multivariable model, controlling for clustering, patients older than 75 years were 41% more likely to meet the general depression screening measure (AOR: 1.41; 95%CI: 1.05-1.90) but there was no significant difference for the other measures. Female gender was not significantly correlated with any of the measures. Correlates for the measure "depression remission at 12 months" could not be determined due to small denominator sample size.(Table 2)

Discussion

Overall, screening for depression among Medicare patients in a diverse network of primary care practices using an EHR was low, at 17%. Eighty-two percent of patients who

were screened at least once for depression were screened more than once. Performance on quality measures was generally low, varying from 10% for screening for depression reduction to 77% for depression remission at 12 months. The variability in meeting the quality measures suggests that incentives for some measures (e.g. use of the PHQ-9 tool) would have more room for improvement than measures that are already met by a larger proportion of patients. In our multivariable model, only black race compared to white race significantly increased the odds of meeting two of the quality measure numerator criteria (i.e. depression reduction and screening after heart disease) (AOR: 4.19; 95%CI: 1.16-15.19; AOR: 5.57, 95%CI: 1.37-22.57, respectively). Two additional patient characteristics significantly impacted the odds of meeting a quality measure in the multivariable models. Patients 75 years of age or older had increased odds of general depression screening compared to patients less than 75 while controlling for AWV status, sex, and race (AOR: 1.41; 95%CI: 1.05-1.90). Patients with an AWV had higher odds of meeting the quality measure than non-AWV patients in the screening for depression reduction measure AOR: 3.93; 95%CI: 1.46-10.57),

Our results in a Medicare population are similar to results from Minnesota's Community Measurement 2012 Health Care Quality report which had a 5.1% average in a state-wide general population's ability to meet the depression remission measure .[27] Our study found higher rates of depression remission at 12 months (77%); however, as noted above, confidence in this finding is low since only a very small number of patients qualified for the measure (47 people or 1% of the study population). Conversely, our study found fairly similar results to Minnesota's state-wide depression response rate within 12 months (10% compared to 8.7% for this study and Minnesota, respectively). The concern with both the depression remission and response measures is that depressed patients often have cycles of remission and reoccurrence: over half of patients with a single episode of depression

have a recurrent episode; and the second episode of depression is usually within 5 years of the first.[28] Importantly, previous work has found that routinely reviewing patients PHQ-9 scores for patients with at least mild depression was associated with increased odds of patients' depression responding to treatment.[29]

Measuring the impact of processes of care for patients with depression on meaningful patient outcomes is difficult. A systematic review of primary care in the United Kingdom found no evidence that assessing depression severity using a structured tool and subsequent treatment based on that assessment resulted in improved patient outcomes.[30] In the U.S., depression screening was found effective only if "staff-assisted depression care supports are in place"[31], and that caveat is not necessarily being implemented in clinics along with the quality measures. There is some evidence of over-diagnosis of depression by clinicians in the community setting.[32] With, 78% of patients who were diagnosed by their clinician as depressed but did not meet the criteria of major depression, used a prescription psychotic medication.[32] Further, there is only moderate agreement between physicians and patients regarding the degree to which a patient's depression has improved over time.[33]

Structured tools, such as the PHQ-9, are being used for tracking depression severity, [34] even though they were not initially validated for that purpose.[22] Previous work has found that physicians are concerned about the impact of using a structured depression screener on their relationship with patients, and are uncertain when best to employ the screener within the consultation.[35] These concerns may be a reason why few patients were found to be screened for depression, despite the explicit opportunity for screening for half of the sample because of their AWV. Further, the repeat screening of a high percentage of people with low PHQ-9 scores suggests particular clinicians have identified workflows to ameliorate these depression screening barriers.

For older-adults, especially those with multimorbidity, choosing measures that may meet their particular preferences may be a better goal than widespread screening.[36] Especially if, as found in our study, a large proportion of repeated screening is being conducted for patients who are not reporting symptoms of depression on a standardized tool. Indeed, when choosing which quality measures to incentivize, thought should be given to the potential role of stigma associated with depression.[37] Eidus and colleagues suggested that quality measures should be associated with "high-leverage" activities such as care-coordination, team-based care, and the establishment of a therapeutic environment that could result in larger impact on patient outcomes.[38] These types of high-leverage activities are valuable for patients with depression and multimorbidity,[34] and may be an important contributor to high quality care. Organizations promoting depression screening, such as Medicare, should consider integrating incentives for both screening and high-leverage activities together. Medicare's AWV benefit[20] takes steps towards this integration by having patients identify to their primary care physician all physicians from which medical care is being received, but further integrations should be considered.

This study had several limitations. Depression screening data was pulled from structured EHR fields, and there is the possibility that more screening would have been captured in unstructured fields, such as clinician notes. However, incentives for quality measure will likely be based on such structured reports. A second major limitation of this study is the low prevalence of patients in the denominator for some of the quality measures in this study population--particularly the low number of patients who had a PHQ-9 score greater than 9. The findings need to be corroborated in larger samples. Further, the small number of patients in the denominator does provide useful information to policy-makers considering adopting these quality measures.

Conclusion

Only a small proportion of Medicare patients received the recommended screening and follow-up care needed to meet quality measures for depression monitoring and follow-up. Moreover, the denominator population for each of six quality measures assessed was quite small, ranging from 14% to 1% of this sample of 5,000 patients across 34 primary care practices. In the multivariable models controlling for site clustering, there was no consistent patient characteristic that was correlated with screening. Further evaluation and validation of measures of depression care quality should be conducted before these measures are implemented widely. While identifying patients with depression and providing care that helps to mitigate depression symptoms is important, caution should be taken in using quality incentives to achieve this goal.

References

1. U.S. Department of Health and Human Services. HealthyPeople2020: Mental Health and Mental Disorders. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=28. Accessed May 2, 2013.
2. American Academy of Family Physicians. Final 2012 Medicare Physician Fee Schedule. Available at: http://www.aafp.org/online/etc/medialib/aafp_org/documents/policy/fed/background/schedule110711.Par.0001.File.tmp/AAFPSummaryFinal2012MPFS112911.pdf. Accessed May 2, 2013
3. Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). JAMA. 2003 Jun 18;289(23):3095-105.
4. Park M, Unützer J. Geriatric depression in primary care. Psychiatr Clin North Am. 2011 Jun;34(2):469-87
5. Grabovich A, Lu N, Tang W, Tu X, Lyness JM. Outcomes of subsyndromal depression in older primary care patients. Am J Geriatr Psychiatry. 2010 Mar;18(3):227-35.
6. Pickett YR, Ghosh S, Rohs A, Kennedy GJ, Bruce ML, Lyness JM. Healthcare Use Among Older Primary Care Patients With Minor Depression. Am J Geriatr Psychiatry. 2013 Apr 9.
7. National Institute of Mental Health. Older Adults: Depression and Suicide Facts (Fact Sheet). Available at: http://www.nimh.nih.gov/health/publications/older-adults-depression-and-suicide-facts-fact-sheet/index.shtml. Accessed May 6, 2013.
8. medicare.Gov: The official U.S. Government site for Medicare. Your Medicare Coverage: Depression Screening. Available at: http://www.medicare.gov/coverage/depression-screenings.html Accessed March 11, 2014
9. National Quality Forum. Patient Reported Outcomes (PROs) in Performance Measurement. 2013. Jan. Available at: http://www.qualityforum.org/Publications/2012/12/Patient-Reported_Outcomes_in_Performance_Measurement.aspx). Accessed May 29, 2013.
10. Minnesota Community Measurement. Minnesota Health Scores Overview. Available at: www.mnhealthscores.org. Accessed May 4, 2013
11. Centers for Medicare and Medicaid. Additional Information Regarding EP Clinical Quality Measures for 2014 EHR Incentives Programs. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/EP_MeasuresTable_Posting_CQMs.pdf. Accessed May 17, 2013
12. Centers for Medicare and Medicaid Services. Clinical Quality Measures Tipsheet. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/ClinicalQualityMeasuresTipsheet.pdf Accessed July 10, 2013
13. Agency for Healthcare Research and Quality. Depression: percent of clinically significant depression patients with a 50 percent or greater reduction in Patient Health Questionnaire (PHQ) Available at: http://www.qualitymeasures.ahrq.gov/content.aspx?id=27604 Accessed January 24, 2014
14. MN Community Measurement. Depression Utilization of the PHQ-9 Tool. Available at: http://www.qualityforum.org/QPS/0712 Accessed January 24, 2014
15. Agency for Healthcare Research and Quality. Major depression in adults: percentage of post-stroke patients with documentation of screening for major depression. Available at: http://www.qualitymeasures.ahrq.gov/content.aspx?id=37725 Accessed January 24, 2014.
16. Centers for Medicare and Medicaid. 2014 Clinical Quality Measures (CQMs) Adult Recommended Core Measures Available at: https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/2014_CQM_AdultRecommend_CoreSetTable.pdf January, 2013. Accessed March 10, 2014
17. Luchins DJ. Depression screening as a quality indicator. Ment Health Fam Med. Jun 2010; 7(2): 107–113.
18. Centers for Medicare and Medicaid. Physician Quality Reporting System. Available at: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/PQRS/index.html?redirect=/pqrs March 3, 2014. Accessed March 10, 2014
19. Centers for Medicare and Medicaid Services. Medicare Program; Payment Policies Under the Physician Fee Schedule and Other Revisions to Part B for CY 2011 November 29, 2010. Available at: https://

www.federalregister.gov/articles/2010/11/29/2010-27969/medicare-program-payment-policies-under-the-physician-fee-schedule-and-other-revisions-to-part-b-for#h-117 Accessed July 10, 2013
20. Medicare Learning Network: Quick Reference Information: the ABCs of Providing the Annual Wellness Visit. Available at: http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/AWV_Chart_ICN905706.pdf. Accessed November 6, 2012
21. Centers for Medicare and Medicaid. Your Guide to Medicare's Preventive Services. Available at: http://www.medicare.gov/publications/pubs/pdf/10110.pdf Accessed July 10, 2013
22. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16:606–613.
23. Chronic Condition Data Warehouse. Available at: www.ccwdata.org/web/guest/home. Accessed January 24,2014
24. MN Community Measurement. Depression Remission at Twelve Months. Available at: http://www.qualityforum.org/QPS/0710 Accessed January 24, 2014
25. Agency for Healthcare Research and Quality. Major depression in adults in primary care: percentage of patients whose symptoms are reassessed by the use of a quantitative symptom assessment tool (such as PHQ-9) within three months of initiating treatment. Available at: http://www.qualitymeasures.ahrq.gov/content.aspx?id=34076 Accessed January 24, 2014.
26. Agency for Healthcare Research and Quality. Major depression in adults in primary care: percentage of patients with cardiovascular disease with documentation of screening for major depression. Available at: http://www.qualitymeasures.ahrq.gov/content.aspx?id=37724Accessed January 24, 2014.
27. Snowden AM. Minnesota Community Measurement. 2012 Health Care Quality Report. Available at: http://mncm.org/wp-content/uploads 2013/04/2012_Final_HealthCareQualityReport_2.18.13.pdf Accessed March 3, 2014
28. Burcusa SL, Iacono WG. Risk for Recurrence in Depression. Clin Psychol Rev. Dec 2007; 27(8): 959–985.
29. Yeung AS, Jing Y, Brenneman SK, Chang TE, Baer L, Hebden T, Kalsekar I, McQuade RD, Kurlander J, Siebenaler J, Fava M. Clinical Outcomes in Measurement-based Treatment (Comet): a trial of depression monitoring and feedback to primary care physicians. Depress Anxiety. 2012 Oct;29(10):865-73.
30. Shaw EJ, Sutcliffe D, Lacey T, Stokes T. Assessing depression severity using the UK Quality and Outcomes Framework depression indicators: a systematic review. Br J Gen Pract. 2013 May; 63(610):e309-17.
31. O'Connor EA, Whitlock EP, Beil TL, Gaynes BN. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Intern Med. 2009 Dec 1;151(11):793-803
32. Mojtabai R. Clinician-Identified Depression in Community Settings: Concordance with Structured-Interview Diagnoses. Psychother Psychosom 2013;82:161-169.
33. Lubaczewski S, Shepherd J, Fayyad R, Guico-Pabia CJ. Real-world disparities between patient- and clinician-reported outcomes: results from a disease-specific program in depression and anxiety.Prof Case Manag. 2014 Mar-Apr;19(2):63-74
34. Cameron IM, Cardy A, Crawford JR, du Toit SW, Hay S, Lawton K, Mitchell K, Sharma S, Shivaprasad S, Winning S, Reid IC. Measuring depression severity in general practice: discriminatory performance of the PHQ-9, HADS-D, and BDI-II. Br J Gen Pract. 2011 Jul;61(588):e419-26.
35. Katon WJ, Lin EH, Von Korff M, Ciechanowski P, Ludman EJ, Young B, Peterson D, Rutter CM, McGregor M, McCulloch D. Collaborative care for patients with depression and chronic illnesses.N Engl J Med. 2010 Dec 30;363(27):2611-20
36. Giovannetti ER, Dy S, Leff B, Weston C, Adams K, Valuck TB, Pittman AT, Blaum CS, McCann BA, Boyd CM. Performance measurement for people with multiple chronic conditions: conceptual model. Am J Manag Care. 2013 Oct 1;19(10):e359-66.
37. Dowrick C,Leydon GM, McBride A, Howe A, Burgess H, Clarke P, Maisey S, Kendrick T. Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study.BMJ. 2009 Mar 19;338:b663
38. Eidus R, Pace WD, Staton EW. Managing patient populations in primary care: points of leverage.J Am Board Fam Med. 2012 Mar-Apr;25(2):238-44

Table 1. Quality Measures Associated with Depression Care in the Ambulatory Care Setting Used in This Study					
	Title	Numerator	Denominator	Exclusions	Notes
Depression Management	Depression Utilization of the depression screening tool	Adult patients age ≥18 with the diagnosis of major depression or dysthymia (ICD-9 296.2x, 296.3x or 300.4) who have a PHQ-9 tool administered at least once during the four month measurement period.	Adult patients with the diagnosis of major depression or dysthymia (ICD-9 296.2x, 296.3x or 300.4	Bipolar or personality disorder.	Cannot confirm following exclusions: death, are a permanent resident of a nursing home or are enrolled in hospice. Four month measurement period was January-March, 2011.
Depression Resassessment	Percent of patients whose symptoms are reassessed by the use of a quantitative symptom assessment tool within three months of initiating treatment.	Number of patients whose symptoms are reassessed by the use of a quantitative symptom severity scale instrument (such as Patient Health Questionnaire [PHQ-9]) within three months of initiating treatment	Number of primary care patients with new diagnosis of major depression	-	New diagnosis of depression was determined if a patient was diagnosed for depression within one year of the index visit.
Screening after stroke	Percent of post-stroke patients with documentation of screening for major depression.	Number of patients screened for depression during post-stroke	Number of patients seen post-stroke		Stroke defined with the following ICD-9 codes: 430 431 433.01 433.11 433.21 433.31 433.81 433.91 434.00 434.01 434.10 434.11 434.90 434.91 435.0 435.1 435.3 435.8 435.9 436 997.02
Screening after heart disease	Percent of patients with cardiovascular disease with documentation of screening for major depression	Number of patients screened for depression during cardiovascular visit	Number of patients with cardiovascular disease diagnosis		This measure specifies it should be used during a cardiovascular visit, but unable to determine what type of visit. Additionally, calculated using codes for heart disease.

Table 1. Quality Measures Associated with Depression Care in the Ambulatory Care Setting Used in This Study

	Title	Numerator	Denominator	Exclusions	Notes
Screening for depression reduction	Clinically significant depressed patients with 50% reduction in PHQ.	All patients with a diagnosis of clinically significant depression* who have a 50 percent or greater reduction in Patient Health Questionnaire (PHQ)	All clinically significant depression* patients		*Clinically significant depression = Patient with a diagnosis of depression and a New Episode Patient Health Questionnaire (PHQ) ≥10 To increase denominator, defined as new diagnosis of depression OR PHQ-9 ≥10 on index.
Screening for depression remission	Depression Remission at Twelve Months	Adults age 18 and older with a diagnosis of major depression or dysthymia and an initial PHQ-9 score greater than nine who achieve remission at twelve months as demonstrated by a twelve month (+/- 30 days) PHQ-9 score of less than five.	Adults with a diagnosis of major depression or dysthymia and an initial PHQ-9 score greater than nine.	Bipolar or personality disorder.	Cannot confirm following exclusions: death, are a permanent resident of a nursing home or are enrolled in hospice. 4-month measurement period was January-March, 2011

Table 2. Odds of Meeting Measure Numerator Criteria by Patient Characteristics												
Variable	General Screening (N=4828-4971)		Depression Management (N=671-694)		Depression Reassessment (N=269-273)		Depression Reduction (N=641-664)		Screening after stroke (N=295-303)		Screening after heart disease (N=256-258)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Bivariate model with site clustering												
Age ≥75 years (ref = <75 years)	1.15	0.87-1.52	0.58	0.28-1.25	1.17	0.41-3.40	1.17	0.54-2.50	0.45	0.14-1.50	1.04	0.03-35.28
AWV index visit (ref = non-AWV)	0.42**	0.31-0.58	0.73	0.30-1.81	0.78	0.20-3.04	3.72**	1.41-9.76	0.85	0.22-3.29	0.65	0.17-2.48
Black race (ref= White)	1.28	0.90-1.82	2.63*	1.15-6.00	4.11*	1.17-14.48	1.80	0.77-4.17	-	-	5.23*	1.35-20.24
Other race (ref = White)	0.60	0.23-1.60	1.20	0.10-4.00	2.42	0.21-27.58	1.10	0.09-13.9	-	-	5.87	0.34-102.51
Female (ref =male)	1.10	0.83-1.45	0.78	0.36-1.70	0.90	0.27-3.05	0.86	0.39-1.90	0.35	0.10-1.20	-	-
Multivariable model with site clustering												
Age ≥75 years (ref = <75 years)	1.41*	1.05-1.90	0.59	0.27-1.30	1.23	0.41-3.71	1.02	0.45-2.32	-	-	1.22	0.37-4.02
AWV index visit (ref = non-AWV)	0.75	0.55-1.02	0.78	0.31-1.97	0.71	0.17-3.02	3.93**	1.46-10.57	-	-	0.65	0.16-2.67
Black race (ref= White)	1.0	0.69-1.45	2.26	0.96-5.33	4.19*	1.16-15.19	2.17	0.90-5.19	-	-	5.57*	1.37-22.57
Other race (ref = White)	0.31*	0.10-0.97	1.07	0.76-15.00	1.98	0.15-25.73	1.12	0.07-17.59	-	-	6.46	0.34-122.93
Female (ref =male)	1.29	0.96-1.73	0.69	0.31-1.54	0.90	0.15-25.73	0.79	0.34-1.88	-	-	0.66	0.19-2.28

Abbreviations: AOR = Adjusted odds ratio

* indicates significance at the p≤0.05 level

** indicates significance at the p≤0.01 level

Discussion

Throughout this study, depression screening was found to be low. With overall depression screening found to be 17%. When assessing the impact of Medicare's Annual Wellness Visit (AWV) on depression screening, low screening was also found with 15% of non-AWV patients and 10% of AWV patients receiving a screen on their index visit. Depression screening was then compared to smoking screening to see if preventive screening for a physical health outcome was similarly low. Instead, smoking screening was found to occur at ~90% of patients' visits, and depression screening almost never occurred in isolation of smoking screening. These results show that there is an inequity in preventive screening for depression compared to smoking screening. Further, a policy requiring depression screening during a specific visit was insufficient to increase depression screening to rates similar to smoking screening.

There was also a clear site effect on screening behaviors. One site (site 34) screened a majority of their patients for depression on the patients' index visit, regardless of index visit type. Six sites never screened any of their AWV index patients for depression. Further, when screening was assessed longitudinally, site 34 continued to screen patients for both depression and smoking at a high rate. Indeed, 82% of patients screened for depression at least once were screened a second time. This is especially notable since 63% of patients screened at least once for depression scored a zero on all depression screens. Demonstrating that there was am impact of clinic proclivity for screening on depression screening rates. These findings suggest that the efficiency of different clinic workflows for preventive-care screening should be considered, especially when trying to meet depression quality of care indicators.

In paper 3, the the current quality of depression care based on 7 quality measures was evaluated. Overall, the rate of measure completion was variable, ranging between 10%

to 77%. Very few patients (n=47) had a depression screening score >9 on any screen. Indicating that among people screened, scores indicative of depression on the standard screening tool was low. Further evaluation and validation of measures of depression care quality should be conducted before these measures are implemented widely. Especially since in this study, the denominator population for each measure was small, ranging from 14% to 1% of the sample; and good quality measures should impact a large proportion of the target population to increase care efficiency. Use of patient-reported measures as quality indicators will increase with the proliferation of pay-for-quality initiatives. For example, clinical quality measures associated with the Meaningful Use program include depression screening.[1] Therefore, understanding the impact of using patient-reported depression screening as a quality indicator for mental health care, and assessing the value of widespread depression screening is essential.

This work has several strengths. First, the large number of patients, across 34 primary care practices, with data collected over a two-year period provide substantial external generalizability for this study. This strength is tempered since data was collected in one state under one medical group. Yet, the heterogeneity of depression screening practices suggest that variation within this medical group may be comparable of general variation in screening practices. Another strength is the current policy relevance of this study. To my knowledge, this is the first study that evaluates the impact of Medicare's AWV on depression screening. This study only focused on screening using the Patient Health Questionnaire, and structured data fields in the electronic health record, which may have underestimated the true amount of screening. Importantly, quality measures associated with Meaningful Use will be collected through structured data fields. Therefore, this study's use of structured data fields increases the relevance of these findings since they are reflective of data reported to obtain Meaningful Use incentives. A major limitation of this study is that I am unable to determine

how screening was administered within each clinic. Clinic workflow associated with screening may be an important factor in depression screening rates. Future work should focus on which clinic workflows associated with depression screening provide optimal quality of care.

Depression is an important disease that is treatable.[2-5] Screening for depression in accordance to evidenced-based practice is important,[6] but assuring the structure of depression screening is equitable and of high quality is vital.

References

1. Centers for Medicare and Medicaid. Additional Information Regarding EP Clinical Quality Measures for 2014 EHR Incentives Programs. Available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/EP_MeasuresTable_Posting_CQMs.pdf. Accessed May 17, 2013
2. National Institute of Mental Health. Older Adults: Depression and Suicide Facts (Fact Sheet). Available at: http://www.nimh.nih.gov/health/publications/older-adults-depression-and-suicide-facts-fact-sheet/index.shtml. Accessed May 6, 2013.
3. Kessler RC, Berglund P, Demler O, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). JAMA. 2003 Jun 18;289(23):3095-105.
4. Park M, Unützer J. Geriatric depression in primary care. Psychiatr Clin North Am. 2011 Jun;34(2):469-87
5. Kravitz RL, Ford DE. Introduction: chronic medical conditions and depression--the view from primary care. Am J Med. 2008 Nov;121(11 Suppl 2):S1-7.
6. U.S. Preventive Service Task Force. Screening Depression in Adults. Available at: http://www.uspreventiveservicestaskforce.org/uspstf09/adultdepression/addeprrs.htm. Accessed May 29, 2013.

Appendix:

I. Additional information for Paper #1: Impact of Medicare Annual Wellness Visits on Depression Screening

ICD-9 codes used in the analysis

Four representative diagnoses known to be prevalent and strongly associated with depression were included in the analysis: cancer (ICD-9 codes 174.0, 174.1, 174.3-174.9, 175.0, 175.9, 153.0-153.8, 154.0, 185, 233.4, 162.2-162.5, 162.8, 162.9, 231.2, V10.11, 182.0, 233.2, V10.42), diabetes (ICD-9 codes 250.00, 250.01, 250.02, 250.40, 250.42, 250.50, 250.70, 250.72, 250.80, 250.81, 250.82, 250.90, 250.92, 362.01-362.04 362.06, 366.41), hypertension (ICD-9 codes 401.0, 401.1, 401.9, 402.00, 402.01, 402.10, 402.90, 402.91, 403.00, 403.10, 403.90, 404.00-404.03, 404.10-404.13, 404.90-404.93, 405.01, 405.09, 405.11, 405.19, 405.99, 437.2) and Alzheimer's dementia (ICD-9 codes 290.0, 290.10-290.13, 290.20, 290.21, 290.3, 290.40-290.43, 294.0, 294.10, 294.11, 294.8, 331.0, 331.11, 331.91, 331.2, 331.7, 797).

Table A. Logistic Regressions- Model Fit Statistics						
Model*	AIC	BIC	McFadden's Adjusted R2	Log liklihood 1st level	Log liklihood 2nd level	Log liklihood 3rd level
1	3635.582	-20.855	0.006	-1814.791	-655.09215	-526.91523
2	3639.423	-12.526	0.005	-1814.712	-654.19167	-526.66773
3	3634.519	-12.942	0.007	-1810.260	-652.77041	-524.81996
4	3270.233	-366.253	0.106	-1625.116	-650.83069	-523.77056
5	3649.842	-5.132	0.002	-1809.921	-652.74123	--
6a	3287.137	-352.374	0.102	-1623.568	-650.56623	-523.8177
6b	3272.734	-359.265	0.106	-1624.367	-650.60216	--
7	3282.470	-356.775	0.103	-1621.235	-650.07796	-523.30721
8	3288.310	-351.200	0.101	-1624.155	-650.04827	-523.11455
9	3287.663	-351.848	0.101	-1623.831	-648.89835	-522.79367
10	3287.149	-352.361	0.102	-1623.574	-650.43006	-523.71746

*Models were run using step-wise analysis. Model numbers correspond to the variables listed in the top row of Tables B-D.

Table B. The impact of index visit on depression screening: patient level with step-wise added confounders											
Model	Index Visit (ref = non-AWV)	Sex (ref =male)	Age (ref = < 75)	Black race (ref= White)	Other race (ref = White)	Age*Sex (ref = Male* <75)	Comorbidities (ref = none)	Cancer (ref = no)	Diabetes (ref = no)	Hypertension (ref=no)	Dementia (ref = no)
	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)
1	0.62 (0.05)**	--	--	--	--	--	--	--	--	--	--
2	0.62** (0.05)	1.04 (0.09)	--	--	--	--	--	--	--	--	--
3	0.62** (0.05)	1.03 (0.09)	1.30** (0.11)	--	--	--	--	--	--	--	--
4	1.19 (0.12)	0.88 (0.82)	1.48** (0.14)	6.14** (0.63)	0.43* (0.18)	--	--	--	--	--	--
5	0.62** (0.05)	1.10 (0.13)	1.23 (0.14)	--	--	1.16 (0.21)	--	--	--	--	--
6a	1.22* (0.13)	0.97 (0.12)	1.34** (0.16)	6.09** (0.63)	0.43* (0.18)	1.27 (0.24)	1.15 (0.12)	--	--	--	--
6b	1.22 (0.13)	0.87 (0.8)	1.47** (0.14)	6.07** (0.63)	0.43** (0.18)	--	1.14 (0.43)	--	--	--	--
7	1.20 (0.12)	1.00 (0.13)	1.35** (0.16)	6.15** (0.63)	0.43* (0.18)	1.26 (0.24)	--	1.38* (0.17)	--	--	--
8	1.20 (0.12)	0.97 (0.12)	1.36** (0.16)	6.08** (0.63)	0.42* (0.18)	1.26 (0.24)	--	--	1.06 (0.11)	--	--
9	1.20 (0.12)	0.97 (0.12)	1.34* (0.16)	6.03** (0.63)	0.43* (0.18)	1.27 (0.24)	--	--	--	1.14 (0.15)	--
10	1.20 (0.12)	0.97 (0.12)	1.32* (0.16)	6.12** (0.63)	0.42* (0.18)	1.28 (0.24)	--	--	--	--	1.28 (0.25)

Table C. The impact of index visit on depression screening: patient level with step-wise added confounders and physician clustering

Model	ICC	Index Visit (ref = non-AWV)	Sex (ref =male)	Age (ref = < 75)	Black race (ref= White)	Other race (ref = White)	Age*Sex (ref = Male* <75)	Comorbidities (ref = none)	Cancer (ref = no)	Diabetes (ref = no)	Hypertension (ref=no)	Dementia (ref = no)
		OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)
1	0.83 (0.03)	1.28 (0.28)	--	--	--	--	--	--	--	--	--	--
2	0.85 (0.3)	1.28 (0.27)	1.25 (0.21)	--	--	--	--	--	--	--	--	--
3	0.85 (0.3)	1.31 (0.28)	1.25 (0.21)	1.31 (0.21)	--	--	--	--	--	--	--	--
4	0.85 (0.3)	1.32 (0.28)	1.25 (0.21)	1.31 (0.21)	0.98 (0.22)	0.33 (0.20)	--	--	--	--	--	--
5	0.85 (0.3)	1.31 (0.28)	1.21 (0.27)	1.36 (0.28)	--	--	0.93 (0.3)	--	--	--	--	--
6a	0.85 (0.3)	1.34 (0.28)	1.20 (0.26)	1.35 (0.28)	0.97 (0.22)	0.34 (0.20)	0.92 (0.30)	1.13 (0.21)	--	--	--	--
6b	0.85 (0.3)	1.35 (0.29)	1.25 (0.21)	1.31 (0.21)	0.97 (0.22)	0.34 (0.20)	--	1.13 (0.21)	--	--	--	--
7	0.85 (0.3)	1.33 (0.28)	1.22 (0.26)	1.35 (0.27)	0.97 (0.22)	0.33 (0.20)	0.91 (0.30)	--	1.31 (0.29)	--	--	--
8	0.85 (0.3)	1.28 (0.27)	1.17 (0.26)	1.35 (0.28)	1.02 (0.23)	0.34 (0.20)	0.89 (0.29)	--	--	0.81 (.14)	--	--
9	0.85 (0.3)	1.35 (0.29)	1.22 (0.27)	1.32 (0.27)	0.92 (0.20)	0.32 (0.19)	0.95 (0.31)	--	--	--	1.14 (0.15)	--
10	0.85 (0.3)	1.32 (0.28)	1.18 (0.26)	1.33 (0.28)	0.97 (0.21)	0.32 (0.19)	0.91 (0.30)					1.37 (0.51)

Table D. The impact of index visit on depression screening: patient level with step-wise added confounders and physician and site clustering

Model	Physician-ICC	Physician & site-ICC	Index Visit (ref = non-AWV)	Sex (ref =male)	Age (ref = < 75)	Black race (ref= White)	Other race (ref = White)	Age*Sex (ref = Male* <75)	Comorbidities (ref = none)	Cancer (ref = no)	Diabetes (ref = no)	Hypertension (ref=no)	Dementia (ref = no)
			OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)	OR (SD)
1	0.43 (0.33)	0.87 (0.04)	1.26 (0.29)	--	--	--	--	--	--	--	--	--	
2	0.43 (0.33)	0.87 (0.04)	1.27 (0.29)	1.14 (0.21)	--	--	--	--	--	--	--	--	
3	0.44 (0.33)	0.87 (0.04)	1.32 (0.30)	1.15 (0.21)	1.41 (0.25)	--	--	--	--	--	--	--	
4	0.44 (0.33)	0.87 (0.04)	1.33 (0.30)	1.14 (0.21)	1.42 (0.26)	1.08 (0.26)	0.44 (0.28)		--	--	--	--	
5	--	--	--	--	--	--	--	--	--	--	--	--	
6a	0.70 (0.55)	0.87 (0.04)	1.33 (0.31)	1.14 (0.21)	1.42 (0.26)	1.08 (0.26)	0.44 (0.28)	1.00 (0.21)	--	--	--	--	
6b	--	--	--	--	--	--	--	--	--	--	--	--	
7	0.44 (0.33)	0.87 (0.04)	1.35 (0.31)	1.16 (0.22)	1.40 (0.25)	1.08 (0.25)	0.44 (0.28)	--	1.27 (0.31)	--	--	--	
8	0.44 (0.33)	0.87 (0.04)	1.30 (0.30)	1.12 (0.21)	1.40 (0.25)	1.13 (0.27)	0.45 (0.29)	--	--	0.80 (0.15)	--	--	
9	0.44 (0.33)	0.87 (0.04)	1.36 (0.31)	1.13 (0.21)	1.40 (0.25)	1.02 (0.24)	0.42 (0.27)	--	--	--	1.40 (0.27)	--	
10	0.44 (0.33)	0.87 (0.04)	1.34 (0.31)	1.13 (0.21)	1.41 (0.26)	1.08 (0.26)	0.44 (0.28)					1.14 (0.47)	

Table E. Detailed Physician Correlation Information for Multilevel Logistic Regressions		
	Physician Variance	**Physician ICC**
Bivariate Analysis		
AWV index Visit	18.05 (11.0, 29.73)	0.85 (.77, .90)
Female	17.93 (10.90, 29.50)	0.84 (.77, .90)
Age	17.81 (10.83 29.30)	0.84 (.77, .90)
Race	17.79 (10.79, 29.34)	0.84 (.77, .90)
Sensitivity analysis		
Multivariate physician clustering no site 34	8.51 (4.41, 16.41)	0.72 (0.57, 0.83)
Multivariate physician clustering site 34	0.96 (0.27, 3.43)	0.23 (0.08, 0.51)

II. Paper #2: Depression screening in primary care: either with smoking-screening or not at all

Table F. Cross-sectional analysis: Impact of Multimorbidity, History of Stroke and Depression on receipt of smoking and depression screening

		Unadjusted Model		Adjusted for Age, Race & Sex	
IV	Comparison*	RRR (95%CI)	P-value	RRR (95%CI)	P-value
Having multimorbidity	No screening	1.07 (0.81-1.41)	0.620	1.48 (1.11-1.97)	0.007
	Smoking status screening only	0.60 (0.50-0.73)	<0.001	0.94 (0.76-0.15)	0.537
History of stroke	No screening	1.22 (0.80-1.89)	0.356	1.44 (0.93-2.24)	0.105
	Smoking status screening only	0.67 (0.48-0.94)	0.019	0.86 (0.61-1.23)	0.421
Having depression	No screening	1.28 (0.91-1.80)	0.157	1.05 (0.74-1.49)	0.771
	Smoking status screening only	1.12 (0.87-1.44)	3.94	0.87 ((0.67-1.15)	0.332

*Multinomial regression analysis with both screening as the reference group

Figure A.

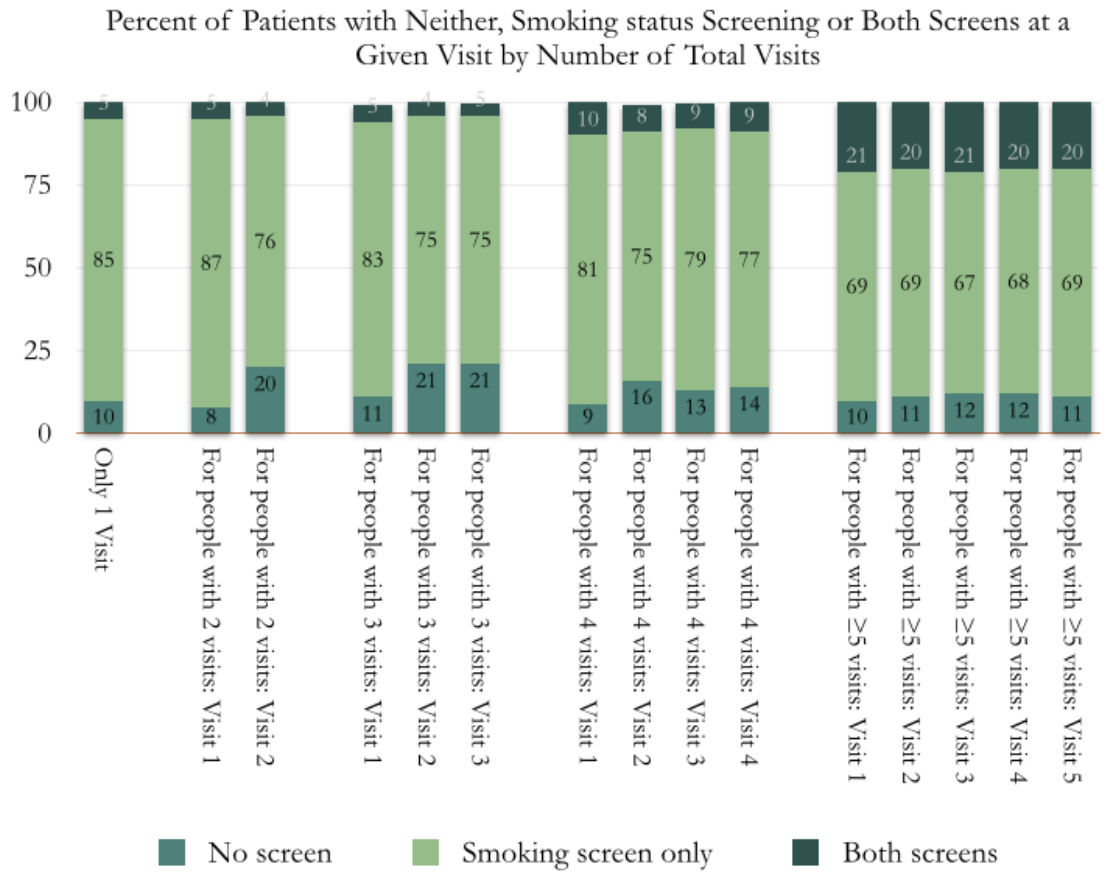

Percent of Patients with Neither, Smoking status Screening or Both Screens at a Given Visit by Number of Total Visits
100
75
50
25
0
5
85
10
Only 1 Visit
5
87
8
For people with 2 visits: Visit 1
4
76
20
For people with 2 visits: Visit 2
5
83
11
For people with 3 visits: Visit 1
4
75
21
For people with 3 visits: Visit 2
5
75
21
For people with 3 visits: Visit 3
10
81
9
For people with 4 visits: Visit 1
8
75
16
For people with 4 visits: Visit 2
9
79
13
For people with 4 visits: Visit 3
9
77
14
For people with 4 visits: Visit 4
21
69
10
For people with ≥5 visits: Visit 1
20
69
11
For people with ≥5 visits: Visit 2
21
67
12
For people with ≥5 visits: Visit 3
20
68
12
For people with ≥5 visits: Visit 4
20
69
11
For people with ≥5 visits: Visit 5
No screen
Smoking screen only
Both screens

Table G. Cross-sectional analysis: Impact of Multimorbidity, History of Stroke and Depression on receipt of smoking and depression screening with no site clustering					
		Unadjusted Model		Adjusted for Age, Race & Sex	
IV	Comparison*	Or (95%CI)	P-value	OR (95%CI)	P-value
Having multimorbidity	No screening versus any screening (ref = no screening)	0.60 (0.48-0.75)	<0.001	0.64 (0.51-0.80)	<0.001
	No screening versus smoking screening (ref = no screening)	0.56 (0.45-0.70)	<0.001	0.64 (0.51-0.80)	<0.001
	No screening versus both screenings (ref = no screening)	0.93 (0.71-1.23)	0.620	0.77 (0.57-1.04)	0.09
	Smoking screening versus both screenings (ref = smoking screening alone)	1.67 (1.38-2.02)	<0.001	1.04 (0.85-1.29)	0.689
	No screening or smoking screening versus both screening (ref = no screening or both screens)	1.57 (1.30-1.90)	<0.001	1.01 (0.82-1.23)	0.994
History of stroke	No screening versus any screening (ref = no screening)	0.59 (0.42-0.82)	0.002	0.62 (0.44-0.87)	0.005
	No screening versus smoking screening (ref = no screening)	0.55 (0.39-0.78)	0.001	0.60 (0.43-0.86)	0.005
	No screening versus both screenings (ref = no screening)	0.81 (0.53-1.26)	0.356	0.70 (0.44-1.11)	0.133
	Smoking screening versus both screenings (ref = smoking screening alone)	1.49 (1.07-2.07)	0.019	1.15 (0.80-1.64)	0.456
	No screening or smoking screening versus both screening (ref = no screening or both screens)	1.36 (0.98-1.89)	0.063	1.05 (0.74-1.49	0.770
Having depression	No screening versus any screening (ref = no screening)	0.86 (0.66-1.12)	0.255	0.85 (0.65-1.10)	0.22

Table G. Cross-sectional analysis: Impact of Multimorbidity, History of Stroke and Depression on receipt of smoking and depression screening with no site clustering					
		Unadjusted Model		Adjusted for Age, Race & Sex	
IV	Comparison*	Or (95%CI)	P-value	OR (95%CI)	P-value
	No screening versus smoking screening (ref = no screening)	0.87 (0.67-1.14)	0.311	0.83 (0.63-1.08	0.170
	No screening versus both screenings (ref = no screening)	0.78 (0.56-1.10)	0.157	0.89 (0.62-1.29)	0.550
	Smoking screening versus both screenings (ref = smoking screening alone)	0.90 (0.70-1.15)	0.39	1.17 (0.89-1.54)	0.253
	No screening or smoking screening versus both screening (ref = no screening or smoking screen)	0.88 (0.69-1.13)	0.323	1.11 (0.85-1.45)	0.437

III: Paper #3: Depression Process of Care Completion Rates Among Medicare Part B Beneficiaries

Table H. Quality Measure Completion Rates			
Measure	Denominator	Numerator	Measure completion
General depression screening	5000	869	17%
Depression management	698	69	10%
Depression reassessment	275	42	15%
Screening after stroke	303	64	21%
Screening after heart disease	259	49	21%
Screening for depression reduction	667	68	10%
Screening for depression remission	30	23	77%

Table I. Odds of Meeting Measure Numerator Criteria by Patient Characteristics Clustering by Physician												
Variable	General Screening (N=4828-4973)		Depression Management (N=671-694)		Depression Reassessment (N=269-273)		Depression Reduction (N=641-664)		Screening after stroke (N=295-303)		Screening after heart disease (N=256-258)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Age ≥75 years (ref = <75 years)	0.91	0.64-1.29	0.66	0.28-1.58	0.39	0.04-3.51	0.96	0.37-2.52	1.04	0.03-35.28	1.30	0.33-5.13
AWV index visit (ref = non-AWV)	0.39**	0.25-0.61	1.09	0.34-3.47	2.20	0.31-15.23	4.60*	1.12-18.90	1.05	0.09-12.5	0.44	0.06-2.95
Black race (ref= White)	1.40	0.90-2.20	3.71*	1.34-10.32	13.25*	1.63-107.68	3.85*	1.18-12.58	-	-	23.37**	2.76-197.56
Other race (ref = White)	0.63	0.34-1.80	2.61	0.16-41.60	0.78	0.03-22.6	3.85	0.23-62.9	-	-	9.19**	3.81-22.16
Female (ref =male)	1.12	0.79-1.60	0.70	0.29-1.71	1.24	0.21-7.46	0.60	0.22-1.60	0.24	0.03-2.04	1.77	0.40-7.82

Table J. Sensitivity Analysis: Odds of Meeting Measure Numerator Criteria for the Multivariable Model						
Variable	General Screening (N=4210)		Depression Reassessment (N=246)		Screening after heart disease (N=222)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Age ≥75 years (ref = <75 years)	1.21	0.90- 1.63	1.31	0.44-3.88	1.28	0.37-4.32
AWV index visit (ref = non-AWV)	0.41**	0.30 - 0.57	0.83	0.21-3.21	0.75	0.18-3.15
Black race (ref= White)	1.15	0.78-1.70	3.82*	1.11-13.10	3.71	.87-15.82
Other race (ref = White)	0.46	0.16 - 1.34	1.72	0.15-20.01	5.15	0.30-89.03
Female (ref =male)	0.99	0.74 - 1.34	0.94	0.28-3.20	0.81	0.23-2.90

CURRICULUM VITAE 1/27/14

Elizabeth R. Pfoh, MPH

DEMOGRAPHIC AND PERSONAL INFORMATION

Current Appointments

PhD Candidate, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health

Personal Data:

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Education:

2001-2005	B.A. in History and Psychology (magna cum laude) Northeastern University, Boston, MA
2008-2010	M.P.H in Sociomedical Sciences Mailman School of Public Health, Columbia University, New York, NY
2011-Present	Ph.D. in Health Services Research and Policy Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

Professional Experience

Johns Hopkins University, Department of Health Policy and Management, Baltimore, MD

Research Assistant, Improving Outcomes Research for Acute Respiratory Failure, September 2013-Present

- Co-wrote manuscripts of analysis for publication in peer-review journals
- Conducted analysis on clinical-trial data to determine various tool's ability to evaluate and predict ICU survivors' long-term physical, cognitive, and mental health outcomes.
- Conducted literature reviews to understand the relationship between quality of life and psychological outcomes in ICU patients.

Project Coordinator, Annual Wellness Visit E-Measures Feasibility Study, August 2012 – September 2013

- Analyzed electronic health record data to determine the validity of quality measures
- Co-wrote manuscripts of analysis for publication in peer-review journals
- Facilitated the collection of data elements associated with Medicare's Annual Wellness Visit for electronic quality measures in 34 outpatient practices.
- Drafted research tools including an electronic data pull specification sheet, data collection protocol, a chart abstraction tool and relevant human subjects documentation.
- Communicate regularly with study team members from other institutions including Mathematica, National Committee for Quality Assurance and Johns Hopkins Community Physicians.

Project Coordinator, Ambulatory Near Miss Registry, March 2013 – August 2013

- Developed conceptual framework in which to operationalize questions about ambulatory near-misses
- Developed questions for American College of Physicians national ambulatory near-miss registry

Research Assistant, End-of Life Decision Making Study, Braeger Project, June 2011 – October 2013

- Conducted analysis of surveys and chart reviews to determine outcomes of physician-family meetings
- Created data collection tools for a study that aims to increase communication between physicians and families of advanced cancer patients.

Johns Hopkins University, Evidence-based Practice Center, Baltimore, MD
Research Assistant, Making Heath Care Safer II, September 2011 – September 2012
- Authored a light-review on hand hygiene interventions for Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices.
- Participated on the screening, abstraction and writing of three systematic reviews patient-safety practices for Making Health Care Safer II.

Johns Hopkins Bayview Medical Center, Community Psychiatry Outpatient Practice, Baltimore, MD
Quality Consultant, June 2012 – August 2012
- Evaluated and suggested improvements for an initiative to improve the quality of care provided to clients
- Presented a seminar to staff on basic strategies for measuring quality of care
- Advised on the design of an evaluation of an intervention to reduce hospitalizations and emergency department visits

Weill Cornell Medical College, Div. of Quality & Clinical Informatics, Pediatrics & Public Health, New York, NY
Research Coordinator, August 2009 – August 2011
- Instrumental in developing and refining qualitative and quantitative data collection instruments.
- Coordinated a large randomized-control trial that aims to reduce medication errors.
- Conducted semi-structured interviews with providers, vendors, and grantee leaders across New York.
- Analyzed interview and focus group transcripts using a grounded-theory approach for qualitative studies.
- Facilitated focus-groups across New York State to understand providers' perceived value of EHRs
- Reviewed literature to determine the appropriate theoretical framework for evaluation of projects.
- Supervised 3 Research Assistants engaging in primary data collection for a medication safety study.
- Assisted in developing study design and methodology for both qualitative and quantitative studies.

Research Aide, June 2008 – July 2009
- Drafted and edited scientific manuscripts for submission to peer reviewed journals.
- Prepared submissions to the IRB and drafted quarterly reports for a federally funded grant.
- Assisted in creating a tool to assess provider satisfaction with computerized prescription writing.
- Assisted in drafting tools to identify adverse drug events and medications in a patient population.
- Collected data from healthcare providers to assess satisfaction with a new Electronic Health Record.

Harvard Pilgrim Health Care & Harvard Medical School, Dept. of Ambulatory Care & Prevention Boston, MA
Project Administrator, February 2007 – April 2008
- Oversaw the financial management of two grants totaling ~$200,000 in direct costs annually.
- Drafted quarterly reports for funding agencies to report on grant progress.
- Drafted annual non-competing continuation funding requests.
- Organized meetings with local, regional and national collaborators including the CDC.
- Operated as meeting planner for faculty, fellows, collaborators, and the Teaching Center at DACP.

Research Assistant/Administrative Assistant, October 2005 – January 2007
- Analyzed data for several studies using Stata9.
- Abstracted and maintained the data for telephone surveys and medical records reviews.
- Built and maintained Access databases for study information.
- Assisted in the preparation of grants, progress reports and scientific manuscripts.

RESEARCH ACTIVITIES

Publications:
Peer-reviewed Original Science Research

1. Osorio SN, Abramson EL, **Pfoh ER**, Edwards A, Schottle H, Kaushal R. Risk Factors in Unexplained Medication Discrepancies for Patients Transitioning from the Inpatient to the Outpatient Setting. (In press)

2. Berger Z, Flickinger T, **Pfoh E**, Dy S. Promoting Engagement by Patients and Families to Reduce Adverse Events. BMJ Quality and Safety. 2014; Jan 16 [Epub ahead of print]

3. Dy S, **Pfoh ER,** Salive M, Boyd C. Quality indicators, patient-reported outcomes, and people with multiple chronic conditions. Journal of the American Geriatrics Society. J Am Geriatr Soc. 2013 Dec;61(12):2120-7

4. Abramson EL, **Pfoh ER,** Barron Y, Quaresimo J, Kaushal R. The effects of electronic prescribing by community-based providers on ambulatory medication safety.The Joint Commission Journal on Quality and Patient Safety. 2013; 39(12) 545-552.

5. Winters B, Weaver S, **Pfoh E**, Dy S. Rapid Response Systems (RRS) as a Patient Safety Practice: A Systematic Review. Annals of Internal Medicine. (Ann Intern Med. 2013 Mar 5;158(5 Pt 2):417-25

6. Weaver S, Lubomksi LH, Wilson RF, **Pfoh ER**, Dy SM. Promoting a Culture of Safety as a Patient Safety Strategy: A Systematic Review. Annals of Internal Medicine. Ann Intern Med. 2013 Mar 5;158(5 Pt 2):369-74.

7. Richardson JE, Abramson EL, **Pfoh ER**, Kaushal R; HITEC Investigators. Bridging informatics and implementation science: evaluating a framework to assess electronic health record implementations in community settings. AMIA Annu Symp Proc. 2012;2012:770-8. Epub 2012 Nov 3.

8. Abramson, EL, Patel, V, Malhotra, S, **Pfoh, E**, Osorio, S, Cheriff A, Cole C, Bunce, A, Ash, J, and Kaushal R. "Physician Experiences Transitioning Between an Older versus Newer Electronic Health Record for Electronic Prescribing." International Journal of Medical Informatics. 2012 Aug;81(8):539-48. Epub 2012 Mar 30.

9. Richardson JE, Abramson EL, **Pfoh ER**, Kaushal R. How communities are leveraging the health information technology workforce to implement electronic health records. AMIA Annu Symp Proc.; 2011: 1186–1195.

10. Zandieh S, Abramson EL, **Pfoh ER,** Yoon-Flannery K, Mills S, Edwards A, Barron Y, Kaushal K. Transitioning Between Ambulatory EHRs: A Longitudinal Study of Practitioners' Perspectives. J Am Med Inform Assoc. 2012 May-Jun;19(3):401-6. Epub 2011 Aug 28.

11. **Pfoh ER**, Zandieh S, Edwards A, Kaushal R**.** Satisfaction after the transition from a locally-developed to a commercial EHR at six ambulatory medical practices. Journal of Evaluation in Clinical Practice.2012 Dec;18(6):1133-9.

12. Abramson EL, Malhotra S, Fischer K, Edwards A, **Pfoh ER**, Osorio SN, Cheriff A, Kaushal R. Transitioning Between Electronic Health Records: Effects on Ambulatory Prescribing Safety. J Gen Intern Med. 2011 Aug;26(8):868-74

13. **Pfoh E**, Wessels MR, Goldmann D, Lee GM. Burden and Economic Cost of Group A Streptococcal Pharyngitis. Pediatrics. 2008; 121(2):229-34.

14. Lee GM, Lorick SA, **Pfoh E**, Kleinman K, Fishbein D. Adolescent Immunizations: Missed Opportunities for Prevention. Pediatrics. 2008; 122(4):711-7.

15. Sandora T, **Pfoh E**, Lee GM. Adverse Events After Tetanus-Diphtheria-Acellular Pertussis Vaccine in Healthcare Workers. Infection Control and Hospital Epidemiology. 2009: 20(4): 389-91.

Peer-reviewed reports:

1. Shekelle PG, Wachter RM, Pronovost PJ, Schoelles K, McDonald KM, Dy SM, Shojania K, Reston J, Berger Z, Johnsen B, Larkin JW, Lucas S, Martinez K, Motala A, Newberry SJ, Noble M, **Pfoh E**, Ranji SR, Rennke S, Schmidt E, Shanman R, Sullivan N, Sun F, Tipton K, Treadwell JR, Tsou A, Vaiana ME, Weaver SJ, Wilson R, Winters BD. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Evidence Report No. 211. (Prepared by the Southern California-RAND Evidence-based Practice Center under Contract No. 290-2007-10062-I.) AHRQ Publication No. 13-E001-EF. Rockville, MD: Agency for Healthcare Research and Quality. March 2013. Available at: http://www.ahrq.gov/research/findings/evidence-based-reports/ptsafe-tyuptp.html.

Peer Reviewed Publications Under Review and In Preparation:

1. **Pfoh ER**, Abramson EL, Edwards A, Kaushal R. Comparative assessment of medication history information sources for a community actively engaged in health information exchange (Under review).

2. Abramson EL, Richardson JE, **Pfoh ER**, Kaushal R. Implementing Interoperable Electronic Health Records across New York State: Ten Lessons Learned. (Under review)

3. Chan KS, **Pfoh ER**, Richards TM, Dy SM, Weiner JP. How Well Can We Assess the Quality of Medicare Annual Wellness Visits? (In preparation)

4. Chan KS, **Pfoh ER**, Dy SM, Richards TM, Lasser E, Weiner JP. Accuracy of Electronic Health Record Data for Quality Measures Linked to Medicare's Annual Wellness Visit. (In preparation)

5. Chan KS, **Pfoh ER**, Richards TM, Lasser E, Weiner JP. The Effects of the Annual Wellness Visit on Preventive Care Screenings. (In preparation)

6. **Pfoh ER**, Wu A. Evolution of Near Miss Reporting in the Ambulatory Care Setting: Development of a New Registry. (In preparation)

7. **Pfoh ER,** Dy S. Depression Process of Care Completion Rates in a Medicare Population care.(In preparation)
8. Pfoh ER, Dy S. Association between Use of Medicare's Annual Wellness Visit and Depression Screening. (In preparation)

Abstracts:

1. **Pfoh ER**, Abramson EL, Richardson J, Kaushal R. Factors in Relationships Between Community Grantees and Electronic Health Record Vendors in Support of Community Implementations. [Poster presentation] Academy Health Annual Research Conference. June 2012, Orlando, Florida.

2. Richardson J, Abramson EL, **Pfoh E**, Kaushal R. Bridging Informatics and Implementation Science: Evaluating a Framework to Assess Electronic Health Record Implementations in Community Settings. American Informatics Association Annual Symposium. [Poster presentation] November 2012. Chicago, IL.

3. **Pfoh ER**, Abramson EL, Patel V, Malhotra S, Osorio SN, Cheriff A, Kaushal R. Physician Prescribing Experiences Over Time After Transitioning from an Older to a Newer Electronic Health Record. [Poster presentation] American Informatics Association Annual Symposium. November 2011, Washington, D.C.

4. Abramson EL, Malhotra S, Kischer K, Edwards R, **Pfoh ER,** Osorio SN, Cheriff A, Kaushal R. Transitioning Between Electronic Health Records: Effects on Ambulatory Prescribing Safety. [Poster presentation] American Informatics Association Annual Symposium. November 2011, Washington, D.C.

5. Sandora TJ, **Pfoh E,** Lee GM. Adverse Events after Tdap Vaccine in Healthcare Workers [Poster Presentation]. Pediatric Academic Societies' Annual Meeting: May 2007; Toronto

6. Koch S, Ahmed A, **Pfoh E**, Wessels MR, Lee GM. Group A Streptococcal Bacteremia in Children. [Poster Presentation] Pediatric Academic Societies' Annual Meeting: May 2007; Toronto

7. **Pfoh E**, Wessels MR, Goldmann D, Lee GM. Burden and Cost of Group A Streptococcal Pharyngitis [Poster Presentation]. Infectious Diseases Society of America's Annual Meeting: October 2006;Toronto

8. **Pfoh E**, Wessels MR,Goldmann D, Lee GM. Burden and Cost of Group A Streptococcal Pharyngitis [Speaking Presentation]. Lancefield Society Meeting October 13, 2006;Toronto

9. Lee GM**, Pfoh E,** Fishbein D. Adolescent Health Care Utilization and Immunizations. [Poster Presentation]. Pediatric Academic Societies' Annual Meeting; May 2006; San Francisco.

Extramural Funding

Grants:

- August 2013-July 2014, Alvin R. Tarlov & John E. Ware Jr. Doctoral Dissertation Award, Health Assessment Lab

Other:

- August 2012-July 2014, Agency for Healthcare Research and Quality NRSA Predoctoral Fellow

EDUCATIONAL ACTIVITIES

Educational Publications

Books and Chapters:

1. Wu A, **Pfoh E,** Skinner A, Steinwachs D. The Sickness Impact Profile. Encyclopedia of Quality of Life Research. Michalos AC, Eds. Springer Publishing. In press.

Other media:

1. **Pfoh E,** Dy S. Improving Hand Hygiene Compliance. QuantiaMD

Teaching

Classroom instruction:

- Term 1 2012 and 2013, Quality of Medical Care, Teaching Assistant, Johns Hopkins Bloomberg School of Public Health
- Term 2, 2012 and 2013, Assessing Health Status and Patient Outcomes, Teaching Assistant, Johns Hopkins Bloomberg School of Public Health
- Term 3, 2013 and 2014, Patient Safety and Medical Errors, Teaching Assistant, Johns Hopkins Bloomberg School of Public Health
- Term 2, 2013 Population Health Informatics, Johns Hopkins Bloomberg School of Public Health
- Terms 1-4, 2013-2014 Health Services Research and Policy Seminar, Bloomberg School of Public Health
- Spring Semester, 2014 Fundamentals of Health Policy and Management, Johns Hopkins University
- October 31, 2013, Stata for Survey Data. Lecture in: Advanced Methods for Health Services Research: Research and Design. Johns Hopkins Bloomberg School of Public Health.

ORGANIZATIONAL ACTIVITIES

Editorial Activities

Journal peer review activities

2013-Present Journal of Managed Care, Reviewer

Professional Societies
2012-Present, Academy Health, member, student liaison

Session Chair
June, 2013 Academy Health Annual Research Conference. Session Chair: Return on Investment of Health Information Technology.

RECOGNITION

May 2013, Student Service Award, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health

May, 2006, Honors Program and National Society of Collegiate Scholars, Northeastern University

March 2000, Reggie Lewis Scholarship: a full tuition scholarship awarded for outstanding academic achievement, Northeastern University

OTHER PROFESSIONAL ACCOMPLISHMENTS

2012-2013, Co-Chair: Student Coordination Committee. Department of Health and Public Policy. Johns Hopkins Bloomberg School of Public Health

2013-2014, Research Committee Liaison: Student Coordination Committee. Department of Health and Public Policy. Johns Hopkins Bloomberg School of Public Health

2013, Certificate in Public Health Informatics, Johns Hopkins Bloomberg School of Public Health